Patent Assignment Abstract of Title

Total Assignments: 1

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Inventor: Yoshiki Uchida

Title: Text color detection for copier image processing

Assignment: 1

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US-PAT-NO: 6631207

DOCUMENT-IDENTIFIER: US 6631207 B2

TITLE: Image processor including processing for image data between edge or boundary portions of image data

DATE-ISSUED: October 7, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Hirota; Yoshihiko	Toyokawa	N/A	N/A	JP
Ishiguro; Kazuhiro	Toyohashi	N/A	N/A	JP

APPL-NO: 09/ 270538

DATE FILED: March 17, 1999

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
JP	10-068988	March 18, 1998

US-CL-CURRENT: 382/167, 358/2.99 , 358/518

ABSTRACT:

In order to improve **character** edge reproducibility in reproducing a color document image, a boundary between a **character and a background is detected in color** image data. Further, if the detected edge

exists at the side of a
character, it is decided as a true edge, and the
image data are subjected to
edge emphasis. Then, when an image is reproduced,
undesirable partial
whitening in characters in the image can be
prevented.

10 Claims, 56 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 52

---------- KWIC ---------

Abstract Text - ABTX (1):
In order to improve **character** edge
reproducibility in reproducing a color
document image, a boundary between a **character and a background is detected in color** image data. Further, if the detected edge
exists at the side of a
character, it is decided as a true edge, and the
image data are subjected to
edge emphasis. Then, when an image is reproduced,
undesirable partial
whitening in characters in the image can be
prevented.

Detailed Description Text - DETX (74):
FIGS. 22A and 22B show the character edge
reproducer 451. The character
edge reproducer 451 performs appropriate image
correction on the C, M, Y and K
data after color correction in accordance with the
result of the discrimination
in the region discriminator 441. Although C, M, Y

and K are processed in parallel, the C, M and Y signals are processed in the same manner, while the K signal is differently processed. The region discrimination result is inputted to a character edge reproduction controller 801. The result is converted to a select signal for switching the corrections in the character edge reproducer 451. The contents of this conversion are changed in accordance with the status of **document mode** signal MODE.sub.3-0 and monochrome image area signal -MCAREA which are inputted together with the region discrimination result. The **document mode** signal is used in order that a user specifies a document on the platen glass plate by the operation panel. This signal includes not only a character mode, a map mode a character photograph mode, a photographic paper photograph mode, a print photograph mode, etc., but also a negative film mode and a positive film mode for an optional film projector, a mode (printer function) for inputting the image from an external apparatus, etc. Herein, the general character photograph mode is described.

Detailed Description Text - DETX (90):

Next, processing on a black character region in a dot image is described. At present, it is not perfectly possible to distinguish a type of a document having black **characters** printed on a light **color background** with a dot-like pattern from another type of a document having black dots printed thereon, because **detection** of an isolated dot for **detecting** dots coexists with **character**

edge **detection**. Consequently, an intermediate processing is applied to an area in which the black character discrimination and the dot detection coexists. In the area, the smoothing is not performed so that a black character is prevented from being blurred. The edge emphasis is not performed so that moire patterns are prevented. In order to prevent color blur of a black character, the black component is replaced by the maximum color data obtained from the R, G and B data after logarithm correction, and the edge component of the color components (C, M, Y) is attenuated with a Min filter.

US-PAT-NO: 5751921

DOCUMENT-IDENTIFIER: US 5751921 A

TITLE: Document image processing device for converting monochrome images to color images

DATE-ISSUED: May 12, 1998

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Fujimoto; Masakazu	Kanagawa	N/A	N/A	JP

APPL-NO: 08/ 781520

DATE FILED: January 9, 1997

PARENT-CASE:

This application is a continuation of application Ser. No. 08/325,935, filed Oct. 19, 1994, now abandoned.

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
JP	5-284155	October 20, 1993

US-CL-CURRENT: 358/1.9, 345/600

ABSTRACT:

A document image processing device segments a

set of pixels in a document
into a plurality of regions and classifies the
sizes of the characters in the
segmented regions. The characters are converted
into a color image based on
information indicating correspondence between size
and color of the characters.
An image is generated for an output document on the
basis of the converted
color image.

7 Claims, 47 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 47

---------- KWIC ---------

Detailed Description Text - DETX (29):
The character color distinction module 1233
distinguishes regions whose
classifications are characters based on the color.
A distinction criterion
(**threshold** level) is determined based on an **average density of the color** of the
character and the color of the character is
distinguished by **comparing with the threshold** level (step 1308). FIG. 19 shows an
example of a density as the
threshold level for distinction, which is 10%
higher than the average density.
In this embodiment, each of colors Y, M and C is
classified into two types by
comparison as to whether its density is higher or
lower than the threshold
level, that is, colors are classified into 8 types
in total. The classified
data values are transmitted to the character image

conversion module 1234.

Detailed Description Text - DETX (58):

The character color distinction module 3734 distinguishes characters whose color is changed for the purpose of emphasis or the like (step 3809). The distinction criterion (**threshold** level) is determined based on an **average density of color** of the character, and colored characters are distinguished from normal (black) characters by **comparing** the color of the character with the **threshold** level. In an ordinary document, as same as the third embodiment, there are many cases in which color of the characters are different on the logical name basis; therefore distinction is carried out for each of the logical identifiers. FIG. 44 shows an example of a density as the threshold level for distinction, which is 10% higher than the average density. Since there is no data for the components M and Y, threshold levels for these components are 0. Here, an average density is given by multiplying each of density values and area of the density value, which is a total amount of toner in a region, and dividing it by area of the whole region. Distinction is carried out by comparing the values of M, Y and C with the threshold level in this order. In the example of FIG. 43, if it is assumed that a character having the constituent number 50 in the logical identifier 5, namely the constituent "catchword", is larger than the threshold level for C shown in FIG. 44, and a character having the constituent number

59 is not exceeding the threshold level, it is understood that the character having the constituent number 50 is an emphasized character and the character having the constituent number 59 is a normal character. An example of data of the layout structure to which the distinction result is attached is shown in FIG. 45. This data is transmitted to the character image conversion module 3735.

PAT-NO: JP407046410A

DOCUMENT-IDENTIFIER: JP 07046410 A

TITLE: COLOR PICTURE PROCESSING UNIT

PUBN-DATE: February 14, 1995

INVENTOR-INFORMATION:
NAME

SHIMURA, NORIO

ASSIGNEE-INFORMATION:
NAME COUNTRY
CANON INC N/A

APPL-NO: JP05184669

APPL-DATE: July 27, 1993

INT-CL (IPC): H04N001/41, G06T001/00 , G06T009/00

ABSTRACT:

PURPOSE: To encode color picture data while suppressing deterioration in picture quality.

CONSTITUTION: A **color character** area

discrimination section 21 divides input color picture data into **blocks** each comprising 16×16 picture elements to check whether or not each **block** is an area representing a **color character**. A sub sampling ratio changeover section 22 selects a sampling ratio so that a sampling ratio of each block is Y:Cr:Cb=4:2:2 or Y:Cr:Cb=4:1:1 as to each color component Y, Cr, Cb of color picture data based on the check result. Then sampling is executed according to the selected sampling ratio and then DC transformation, linear quantization and entropy coding are executed.

US-PAT-NO: 5296939

DOCUMENT-IDENTIFIER: US 5296939 A

TITLE: Image area discriminating system for an image processing apparatus

DATE-ISSUED: March 22, 1994

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Suzuki; Yuzuru	Kanagawa	N/A	N/A	JP

APPL-NO: 07/ 637026

DATE FILED: January 3, 1991

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
JP	2-2940	January 10, 1990

US-CL-CURRENT: 358/453, 358/462 , 358/538

ABSTRACT:

An image area discriminating system for an image processing apparatus which discriminates between a character area and a halftone area on an original document containing the character and halftone areas, selects parameters for each discriminated area, and adjusts and generates image data. The image area

discriminating system comprises: a block color discriminating unit for grouping pixels into blocks and determining block colors on the basis of the formed pixel blocks; a determining unit for detecting the run lengths of block colors other than white, for comparing the detected run lengths with a predetermined threshold value, and for determining whether the document area is the character area or the halftone area; and an area signal output unit for outputting a signal to select an image area signal on the basis of an output signal outputted from the determining unit.

6 Claims, 18 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 7

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Brief Summary Text - BSTX (26):

The block color determining means detects the hue and determines whether or not a maximum density signal of the input image data exceeds a preset threshold value, and finds the color whose appearance frequency is the largest, for block color discrimination. Accordingly, in the area of low density where is not the character area, even if the short run length is detected, it will never be mistakenly recognized as the character area. The **blocks** whose density exceeds a preset threshold value is recognized as candidates for **characters, thereby to**

discriminate between the color character and the black **character**.

Detailed Description Text - DETX (14):

As seen from the foregoing description, the image area discriminating system of the invention groups the pixels into blocks, and determines block colors. Accordingly, the characters, mesh dots and halftone can be discriminated by using the run length thereof. Further, the image area discriminating system can discriminate between the color original and the black/white original. Accordingly, when applied to an original document having both the character area and the halftone area, the system can accurately discriminate between the areas, through the prescan. The two-level image and the halftone image can both be improved in their reproduction by merely selecting parameters in conformity with the areas, not designating the areas. In the **character** area, it is possible to **discriminate** between a **color character** and a black **character on the basis of the block color**. This implies that if the color character is properly processed, a clean and sharp character can be reproduced. With some additional circuits, the color original or the black/white original can be recognized, so that for the recognized original, the processing suitable for the original may be applied. Therefore, the unnecessary operations in handling the black/white original documents can be removed. Additionally, the hardware to discriminate the image areas is simple in construction but is able to make

the discrimination with high precision.

US-PAT-NO: 6486981

DOCUMENT-IDENTIFIER: US 6486981 B1

TITLE: Color image processing method and apparatus thereof

DATE-ISSUED: November 26, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Shimura; Norio	Yokohama	N/A	N/A	JP
Maeda; Mitsuru	Yokohama	N/A	N/A	JP

APPL-NO: 08/ 887426

DATE FILED: July 2, 1997

PARENT-CASE:

This application is a continuation of application Ser. No. 08/733,456 filed Oct. 18, 1996, now abandoned, which was a continuation of application Ser. No. 08/275,255 filed Jul. 15, 1994, now abandoned.

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
JP	5-184669	July 27, 1993
JP	6-142794	June 24, 1994

US-CL-CURRENT: 358/500, 382/166

ABSTRACT:

A color image processing apparatus which codes image data while suppressing image deterioration. A **color character** area **discrimination** unit divides an input color image into 16.times.16-pixel **blocks, and determines** whether or not each **block** expresses **color characters**. In accordance with the determination result, a sub-sampling ratio switching unit switches the sampling ratio for each of color components YCrCb composing the color image data so that the sample ratio is Y:Cr:Cb=4:2:2 or Y:Cr:Cb=4:1:1. Subsequently, sampling is performed in accordance with the switched sampling ratio, and DCT, linear quantization and entropy coding are then performed.

8 Claims, 18 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 9

---------- KWIC ---------

Abstract Text - ABTX (1):

A color image processing apparatus which codes image data while suppressing image deterioration. A **color character** area **discrimination** unit divides an input color image into 16.times.16-pixel **blocks, and determines** whether or not each **block** expresses **color characters**. In accordance with the determination result, a sub-sampling ratio switching unit

switches the sampling ratio for
each of color components YCrCb composing the color
image data so that the
sample ratio is Y:Cr:Cb=4:2:2 or Y:Cr:Cb=4:1:1.
Subsequently, sampling is
performed in accordance with the switched sampling
ratio, and DCT, linear
quantization and entropy coding are then performed.

US-PAT-NO: 6269186

DOCUMENT-IDENTIFIER: US 6269186 B1

TITLE: Image processing apparatus and method

DATE-ISSUED: July 31, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Makita; Takeshi	Kawasaki	N/A	N/A	JP

APPL-NO: 08/ 993143

DATE FILED: December 18, 1997

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
JP	8-341360	December 20, 1996

US-CL-CURRENT: 382/172, 358/462 , 358/466 , 382/176 , 382/270

ABSTRACT:

This invention relates to an image processing method of quantizing a multivalued image to perform image processing. The luminance frequency of the multivalued image is calculated, a quantization threshold for quantization is specified on the basis of the calculated luminance frequency, a representative

value used for quantization of the multivalued image is calculated on the basis of the specified quantization threshold and the luminance frequency, and the multivalued image is quantized using the calculated representative value. The quantization threshold is an average luminance value obtained when the histogram distribution converges to make the skew of the histogram distribution of the luminance frequency fall within a predetermined range. The representative value is an average luminance value in each distribution region of the histogram distribution of the luminance frequency that is divided by the quantization threshold.

11 Claims, 11 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 11

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Detailed Description Text - DETX (43):

In quantization of this embodiment, the average value of a region at the left **block having a block** unit of 64.times.64 pixels that is smaller than the calculated quantization threshold TH, in this case, the average pixel value BBV of the character region "T" of the character "TITLE" is calculated to be 64. In this **block,** the average value of a region larger than the quantization threshold TH, in this case, the average value WBV of the region corresponding

to the background color is calculated to be 200. BBV and WBV are added in **block** units of 64.times.64 pixels in addition to a normal binarized image. Therefore, the title **character color and the background color** can be **discriminated**.

Detailed Description Text - DETX (50):

WBV and PW are compared with each other. When WBV is smaller than PW, the background color of this **block** is estimated to have a background color darker than the background on the paper sheet. Then, BBV and PB are compared with each other. When BBV is larger than PB, the density of a character printed in this **block** is estimated to be that of a colored character lower than that of a normal black character. Therefore, when WBV is smaller than PW, or BBV is larger than PB, the title in this region is **determined to have a background color or character** color emphasizing the title, and the flow branches to step S1003. Otherwise, the flow shifts to step S1004. In step S1003, the region is labeled "emphasized title". In step S1004, a region is labeled "normal title".

US-PAT-NO: 5838817

DOCUMENT-IDENTIFIER: US 5838817 A
See image for Certificate of Correction

TITLE: Image processing apparatus and method for coding and decoding chromaticity information

DATE-ISSUED: November 17, 1998

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Funada; Masahiro	Yokohama	N/A	N/A	JP

APPL-NO: 08/ 451973

DATE FILED: May 26, 1995

PARENT-CASE:

This application is a continuation of application Ser. No. 08/046,269 filed Apr. 15, 1993, now abandoned.

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
JP	4-097810	April 17, 1992

US-CL-CURRENT: 382/166, 358/426.04 , 358/539 , 382/233 , 382/248

ABSTRACT:

When a pixel block of a color image is coded, the coding is performed by taking the correlation between lightness and chromaticity into account. More specifically, the color data within the pixel block is separated into lightness and chromaticity. Lightness is coded by being subjected to an orthogonal transformation. The coding of chromaticity is performed by detecting the average value of chromaticity and the amplitude of chromaticity of a pixel block, calculating the ratio of chromaticity amplitude to lightness amplitude and then coding chromaticity based upon the calculated ratio and the average value of chromaticity.

32 Claims, 38 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 36

---------- KWIC ---------

Detailed Description Text - DETX (133):

FIG. 28 illustrates the relation between K.sub.2 and b.sub.0, b.sub.1, b.sub.2. For example, if values of b.sub.01 =4/8, b.sub.11 =1/8, b.sub.21 =1/8, b.sub.02 =12/8, b.sub.12 =-1/8, b.sub.22 =-1/8 have been set in the registers 816, 817, 818, 819, 820, 821 in advance, a **smoothing** filter is formed at K.sub.2 =0, namely in a **non-character** (line-drawing) portion, as shown in FIG. 28, so that noise in the high-frequency

components of the image can be eliminated. At K.sub.2 =1, namely in a character (line-drawing) portion, an edge emphasizing filter can be formed to correct for sharpness of character portions.

PAT-NO: JP411215368A

DOCUMENT-IDENTIFIER: JP 11215368 A

TITLE: IMAGE PROCESSOR AND DIGITAL COLOR COPYING MACHINE USING THE SAME

PUBN-DATE: August 6, 1999

INVENTOR-INFORMATION:
NAME COUNTRY
MURATA, KAZUYUKI N/A

ASSIGNEE-INFORMATION:
NAME COUNTRY
MATSUSHITA ELECTRIC IND CO LTD N/A

APPL-NO: JP10302492

APPL-DATE: October 23, 1998

INT-CL (IPC): H04N001/40, G06T001/00

ABSTRACT:

PROBLEM TO BE SOLVED: To reproduce an original image with the image with high image quality by **detecting** a first area which is the inner area of a **block**

character, a second area being the edge area of the black **character and a third area being a color character** except for the black **character**.

SOLUTION: A single color signal edge enhancement circuit synthesizes single color signals from the outputs 41-43 of a line memory and emphasizes edges and outputs the signal. An area identification circuit outputs the detection signal of an area which is made into maximum gray density, the detection signal of an area which is an achromatic color and the detection signal of an area where edge emphasis quantity is made larger than the other areas. An identification processing circuit processes the single color signal which is edge-enhanced in accordance with the area detection signal, outputs the signal and outputs a selection signal to selector. A masking circuit correcting the color of an edge enhanced signal and generating a black component outputs the image signal correcting the color and generating black. Thus, a black bharacter area in an original is discriminated and an original image is reproduced on a recording material only with a black material and the black character is reproduced only with the black color material.

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特開平11－215368

(43)公開日　平成11年(1999)８月６日

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Ｇ０６Ｔ　1/00		Ｇ０６Ｆ　15/66	３１０

審査請求　有　　請求項の数16　ＯＬ　（全 19 頁）

(21)出願番号　特願平10－302492
(62)分割の表示　特願平2－260907の分割
(22)出願日　平成２年(1990)９月28日

(31)優先権主張番号　特願平1－340666
(32)優先日　平１(1989)12月29日
(33)優先権主張国　日本（ＪＰ）
(31)優先権主張番号　特願平2－135045
(32)優先日　平２(1990)５月24日
(33)優先権主張国　日本（ＪＰ）
(31)優先権主張番号　特願平2－148228
(32)優先日　平２(1990)６月５日
(33)優先権主張国　日本（ＪＰ）

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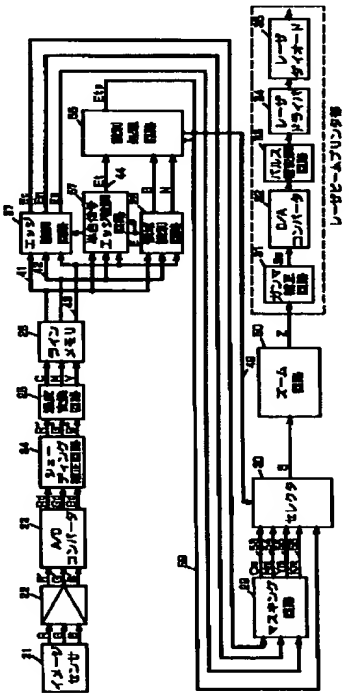
(54)【発明の名称】　画像処理装置及びこの装置を用いたディジタルカラー複写機

(57)【要約】
【課題】　従来の領域識別処理の構成では、エッジ成分のやや小さい文字領域を識別しようとすると、中間調部のエッジ成分のやや大きい領域を文字領域と誤判別し、中間調領域をなめらかに再現できなくなる。また、この誤判別を無くそうとするとエッジ成分が十分大きな文字領域しか識別できなくなり、文字部の再現性が悪くなってしまう。
【解決手段】　黒で印刷された黒文字を含むカラー原稿を読みとり走査して得た複数の色信号から、前記黒文字の内部領域である第１の領域を検出する第１の検出手段と、前記黒文字のエッジ領域である第２の領域を検出する第２の検出手段と、前記黒文字以外の色文字の領域である第３の領域を検出する第３の検出手段を備えることを特徴とする。このことにより、黒文字は黒の色材のみで再現し、黒文字の画質を向上させ、かつ原稿画像の黒文字部以外の領域の文字部として識別する誤識別を低減する。



1

【特許請求の範囲】

【請求項1】　黒で印刷された黒文字を含むカラー原稿を読みとり走査して得た複数の色信号から、

前記黒文字の内部領域である第1の領域を検出する第1の検出手段と、

前記黒文字のエッジ領域である第2の領域を検出する第2の検出手段と、

前記黒文字以外の色文字の領域である第3の領域を検出する第3の検出手段を備える画像処理装置。

【請求項2】　特許請求の範囲第1項記載の画像処理装置の第1の検出手段で検出された第1の画像領域を、黒の色材のみで最大濃度で記録媒体に再現する第1の再現手段と、

前記第2の検出手段で検出された第2の画像領域を、黒の色材のみで前記記録媒体に再現する第2の再現手段と、

前記第3の検出手段で検出された第3の画像領域を、シアン、イエロー、マゼンタおよび黒の色材で前記記録媒体に再現する第3の再現手段とを備えることを特徴とするディジタルカラー複写機。

【請求項3】　カラー原稿を読みとり走査して得た複数の画像信号から単色信号を生成する単色信号生成手段と、前記複数の色信号のエッジ成分を強調するエッジ強調手段と、前記単色信号を2値化し2値信号を出力する2値化手段とを備え、

特許請求の範囲第1項記載の画像処理装置の第1の検出手段で検出された第1の画像領域を、前記2値信号に基づき黒の色材のみで記録媒体に再現する第1の再現手段と、

前記第2の検出手段で検出された第2の画像領域を、前記2値信号に基づき黒の色材のみで記録媒体に再現する第2の再現手段と、

前記第3の検出手段で検出された第3の画像領域を、前記エッジ強調手段によるエッジ強調量を大きくして、シアン、イエロー、マゼンタおよび黒の色材で前記記録媒体に再現する第3の再現手段とを備えることを特徴とするディジタルカラー複写機。

【請求項4】　カラー原稿を読みとり走査して得た複数の画像信号から単色信号を生成する単色信号生成手段と、前記複数の色信号のエッジ成分を強調するエッジ強調手段と、前記単色信号のコントラスト特性を急峻にし疑似2値信号を出力する疑似2値化手段とを備え、

特許請求の範囲第1項記載の画像処理装置の第1の検出手段で検出された第1の画像領域を、前記疑似2値信号に基づき黒の色材のみで記録媒体に再現する第1の再現手段と、

前記第2の検出手段で検出された第2の画像領域を、前記疑似2値信号に基づき黒の色材のみで記録媒体に再現する第2の再現手段と、

前記第3の検出手段で検出された第3の画像領域を、前記エッジ強調手段によるエッジ強調量を大きくして、シアン、イエロー、マゼンタおよび黒の色材で前記記録媒体に再現する第3の再現手段とを備えることを特徴とするディジタルカラー複写機。

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【請求項5】　カラー原稿を読みとり走査して得た複数の画像信号から単色信号を生成する単色信号生成手段と、前記複数の色信号のエッジ成分を強調するエッジ強調手段と、前記エッジ強調手段の出力を所定のズーム率でズーミングするズーミング手段と、前記単色信号のコントラストを急峻にし疑似2値信号を出力する疑似2値化手段と、

特許請求の範囲第1項記載の画像処理装置の第1の検出手段で検出された第1の画像領域を、前記疑似2値信号に基づき黒の色材のみで記録媒体に再現する第1の再現手段と、

前記第2の検出手段で検出された第2の画像領域を、前記疑似2値信号に基づき黒の色材のみで記録媒体に再現する第2の再現手段と、

前記第3の検出手段で検出された第3の画像領域を、前記エッジ強調手段によるエッジ強調量を大きくして、シアン、イエロー、マゼンタおよび黒の色材で前記記録媒体に再現する第3の再現手段とを備え、

前記ズーム率に基づいて、前記疑似2値化手段でのコントラスト変換特性を変更することを特徴とするディジタルカラー複写機。

【請求項6】　前記第1の検出手段は、カラー画像を読みとり走査して得た複数の色信号から画素ごとに1つの色信号を選択して出力する単色信号生成手段と、前記複数の色信号から無彩色であることを検出する無彩色判定手段と、前記単色信号をm×m画素のウインドウで走査しエッジを検出する第1のウインドウ処理手段と、前記単色信号をmより小さいn×nのウインドウで走査してエッジを検出する第2のウインドウ処理手段と、注目画素及びその近傍画素が第2のウインドウ処理手段によりエッジ検出されたことを検出する近傍エッジ検出手段とを備え、注目画素が、第1のウインドウ処理手段，近傍エッジ検出手段，無彩色判定手段により検出されたとき前記第1の画像領域であると検出することを特徴とする特許請求の範囲1項記載の画像処理装置。

【請求項7】　前記第1のウインドウ処理手段は、ウインドウ内の2次微分成分を第1の閾値と比較しエッジを検出するエッジ検出手段と、前記2次微分成分と注目画素を加算した値を第2の閾値と比較し濃度を検出する濃度検出手段と、ウインドウ内の複数の画素の最大値と最小値の差を第3の閾値と比較し濃度差を検出する濃度差検出手段の3つの検出手段のうち少なくとも2つの手段を備え、この複数の検出手段により検出したとき、第1のウインドウ処理手段は検出信号を出力することを特徴とする特許請求の範囲第6項記載の画像処理装置。

【請求項8】　前記第2のウインドウ処理手段は、ウイ

ンドウ内の2次微分成分を第1の閾値と比較しエッジを検出するエッジ検出手段と、注目画素を第2の閾値と比較し濃度を検出する濃度検出手段と、ウインドウ内の複数の画素の最大値と最小値の差を第3の閾値と比較し濃度差を検出する濃度差検出手段の3つの検出手段のうち少なくとも2つの手段を備え、この複数の検出手段により検出したとき、第2のウインドウ処理手段は検出信号を出力することを特徴とする特許請求の範囲第6項記載の画像処理装置。

【請求項9】　特許請求の範囲第3項、第4項、第5項および第6項記載の単色生成手段は、複数の色信号から1つの輝度もしくは濃度に対応する信号を合成する手段であることを特徴とする特許請求の範囲第3項、第4項、第5項および第6項記載の画像処理装置。

【請求項10】　前記第2の検出手段は、カラー画像を読みとり走査して得た複数の色信号から1つの単色信号を生成する単色信号生成手段と、前記複数の色信号から無彩色であることを検出する無彩色判定手段と、前記単色信号をm×m画素のウインドウで走査しエッジを検出する第1のウインドウ処理手段と、前記単色信号をmより小さいn×nのウインドウで走査してエッジを検出する第2のウインドウ処理手段と、注目画素及びその近傍画素が第2のウインドウ処理手段によりエッジ検出されたことを検出する近傍エッジ検出手段とを備え、注目画素が、第1のウインドウ処理手段，近傍エッジ検出手段，無彩色判定手段により検出されたとき前記第2の画像領域であると検出することを特徴とする特許請求の範囲1項記載の画像処理装置。

【請求項11】　特許請求の範囲第6項および第10項記載の無彩色判定手段は、カラー原稿を読み取り走査して得た複数の色信号のより無彩色を検出する無彩色検出手段を備え、前記無彩色検出手段の出力をk×kのウインドウで走査し、ウインドウ内の画素がすべて無彩色と検出されるとき、無彩色判定信号を出力することを特徴とする特許請求の範囲第6項及び第10項記載の画像処理装置。

【請求項12】　特許請求の範囲第11項記載の無彩色検出手段は、カラー原稿を読み取り走査して得た複数の色信号のうち最大値と最小値の差が所定の値以下であるとき無彩色を検出することを特徴とする特許請求の範囲第11項記載の画像処理装置。

【請求項13】　前記第3の検出手段は、カラー画像を読みとり走査して得た複数の色信号から1つの単色信号を合成する単色信号生成手段と、前記単色信号をm×m画素のウインドウで走査しエッジを検出する第1のウインドウ処理手段と、前記単色信号をmより小さいn×nのウインドウで走査してエッジを検出する第2のウインドウ処理手段と、注目画素及びその近傍画素が第2のウインドウ処理手段によりエッジ検出されたことを検出する近傍エッジ検出手段とを備え、注目画素が第1のウインドウ処理手段および近傍エッジ検出手段により検出されたとき前記第3の画像領域であると検出することを特徴とする特許請求の範囲1項記載の画像処理装置。

【請求項14】　特許請求の範囲第10項および第13項記載の第1のウインドウ処理手段は、ウインドウ内の複数の画素の最大値と最小値の差を所定の閾値と比較しエッジを検出することを特徴とする特許請求の範囲第10項および第13項記載の画像処理装置。

【請求項15】　特許請求の範囲第10項および第13項記載の第2のウインドウ処理手段は、ウインドウ内の画像信号を第1の閾値でクリップするクリップ手段と、クリップ手段によりクリップされた画像信号の2次微分成分を第2の閾値と比較しエッジを検出するエッジ検出手段と、注目画素が第1の閾値以上であることを検出するクリップ画素検出手段を備え、前記エッジ検出手段とクリップ画素検出手段により検出したとき、第2のウインドウ処理手段は検出信号を出力することを特徴とする特許請求の範囲第10項および第13項記載の画像処理装置。

【請求項16】　特許請求の範囲第10項および第13項記載の単色生成手段は、複数の色信号のうち最も明るい色信号を選択する手段であることを特徴とする特許請求の範囲第10項及び第13項記載の画像処理装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、カラー原稿を読み取って、画像処理を施し、原稿画像を記録媒体上に再生するディジタルカラー複写機、カラーファクシミリ、画像ファイルシステム等に使用される画像処理装置に関するものである。

【0002】

【従来の技術】近年、ディジタルカラー複写機等では高機能化が求められており、イメージスキャナで読み取った画像信号のエッジ量を適切に補正したり、地図原稿の場合にはエッジ強調量を多くしたりするエッジ強調処理も高機能化の一翼を担っている。

【0003】また、ディジタルカラー複写機などに用いられるカラー原稿は、黒文字部と中間調写真部が混在していることが多く、黒文字部は色付きなくシャープなエッジで再生し、中間調部は色再現性よくなめらかな階調特性で再生することが求められており、黒文字領域を誤識別や識別漏れなく識別し、適切な処理を行なう領域識別処理が必要である。

【0004】以下図面を参照しながら、ディジタル複写機における従来のエッジ強調処理の一例についてその構成および動作を説明する。

【0005】図1は従来のディジタル複写機の信号処理のブロック図、図2は、従来のエッジ強調回路の演算方法を示すものである。

【0006】図1において、1は入力となる原稿を示

し、2はレンズ、3はイメージセンサであるCCDである。4はCCD3からの出力を増幅する増幅器であり、5はそのアナログ量をディジタルに変換するA/Dコンバータである。6はシェーディング補正回路であり、7はエッジ強調判別回路である。このエッジ強調判別回路7は、入力画像に対してエッジ強調するか否かを判別して、エッジ部を強調する場合は次のエッジ強調回路8に入力信号を渡し、エッジ強調しないときには、入力信号を画像処理回路9に渡す。なおこの判別は注目画素の濃度と、注目画素から所定の距離範囲内にある複数の周辺画素の濃度との差の絶対値が、所定の値より大きいときは、エッジ強調を行い、小さいときはエッジ強調を行わないというものである。画像処理回路9では、エッジ強調回路8の出力信号処理する、例えばガンマ補正処理である。10は、画像処理回路9からのディジタル信号をアナログ信号に変換するD/Aコンバータである。11は、D/Aコンバータ10からのアナログ信号に基づいてパルス幅変調信号を出力するレーザ変調回路である。12はレーザダイオード13を駆動するレーザドライバである。

【0007】D/Aコンバータ10、レーザ変調回路11、レーザドライバ12、レーザダイオード13は、周知のレーザビームプリンタの構成要素であり、レーザビームプリンタにより原稿画像を再生する。

【0008】図2はエッジ強調回路の演算方法を示すものであり、3×3の画素ウィンドウの中心が注目画素である。対角の4画素が周辺画素であり、注目画素の濃度に5を乗じた値から周辺4画素の濃度の和を減算することを示している。すなわち、注目画素の濃度に2次微分を減算し、エッジ強調を行う（例えば、特開昭62-183672）。

【0009】以下図面を参照しながら、ディジタルカラー複写機に用いられる従来の領域識別処理の一例についてその構成および動作を説明する。

【0010】図3はディジタルカラー複写機における、従来の領域識別処理回路のブロック図である。

【0011】図3において、R，G，Bは原稿を走査して読み取った色信号である。色信号R，G，Bは、中間調画像用フィルタ処理回路601、2値画像用フィルタ処理回路602及び領域識別回路610に並列的に入力される。中間調画像用フィルタ処理回路601は、注目画素領域が中間調画像領域であると想定して帯域強調処理を行なう2次元フィルタである。このフィルタの周波数特性は網点成分を除去し、かつ画像の鮮鋭度を高めるよう設定する。2値画像用フィルタ処理回路602は、注目画素領域が2値画像領域であると想定して、文字などのエッジ成分の強調処理を行なう。2値化回路603は、後述する色相判別回路605からの色相信号r1，g1，b1がオンのときのみ色信号R，G，Bをそれぞれの閾値で2値化し、r1，g1，b1がオフのときには色信号R，G，Bをそのまま出力する。

【0012】以上のようにして得られた中間調画像用フィルタ処理回路601と、2値化回路603からの2値画像用データとを以下に述べる領域識別回路610からの判定信号によって選択回路604により切り換えて、後の処理回路へ出力する。

【0013】領域識別回路610は、色相判別回路605、領域判定用の閾値を格納する閾値格納ROM606、信号合成回路607、エッジ信号発生回路608、比較器609により構成されている。信号合成回路は色信号R，G，Bより輝度に変換し合成信号dを生成する。

【0014】エッジ信号生成回路608は合成信号dを入力とし注目画素を中心とする3×3の画素ウインドウ内の最大値と最小値の差を演算しエッジ信号eとして出力する。比較器609では、エッジ信号eを、ある特定の閾値と比較して閾値以上であれば2値画像領域として1、閾値よりも小さければ中間調画像領域として0を選択回路604に出力する。色相判別回路605は、注目画素の色相をイエロー、マゼンタ、シアン、ブラック、レッド、グリーン、ブルーの7色相に識別し、色相信号r1、g1、b1を出力する。閾値格納ROMは色相信号r1，g1，b1をアドレス信号とし、色相に応じた領域識別のための判定閾値が8ビット信号として比較器609へ出力する。比較器609は、色相毎の閾値とエッジ信号生成回路608からのエッジ信号eを比較して、中間調領域か文字領域かを識別し、選択回路604のよりそれぞれの領域に適した処理を行なった信号を選択し、色補正及び下色除去回路611へ信号r，g，bとして出力する。色補正及び下色除去回路611では、色の濁りの補正を行なうとともに、下色除去処理を行ないシアン（C）、マゼンタ（M）、イエロー（Y）、ブラック（K）信号を生成する。図示していないカラープリンタは、各色に対応する色材で記録媒体に原稿画像を再現する（例えば、特開昭64-41377）。

【0015】

【発明が解決しようとする課題】しかしながら、上記のような領域識別処理の構成では、エッジ成分のやや小さい文字領域を識別しようとすると、中間調部のエッジ成分のやや大きい領域を文字領域と誤判別し、中間調領域をなめらかに再現できなくなる。また、この誤判別を無くそうとするとエッジ成分が十分大きな文字領域しか識別できなくなり、文字部の再現性が悪くなってしまう。

【0016】更に、文字部、特に文字写真混在原稿の再生時に重要な黒文字部については、黒の色材のみで黒文字を再現する方がカラープリンタの一般的な特性上、再現性が良くなる。なぜなら、カラープリンタはシアン、イエロー、マゼンタ及びブラックの色材を記録材上に重ねることによりカラー画像を再現するが、シアン、イエロー及びマゼンタの色材を重ねて黒を再現する場合、十

分な無彩色度と濃度を得ることは困難であり、また色重ね時の位置ずれによって黒文字のエッジ部に色付きが生じることがあるからである。

【００１７】本発明は上記課題に鑑み、黒文字は黒の色材のみで再現し、黒文字の画質を向上させ、かつ原稿画像の黒文字部以外の領域の文字部として識別する誤識別を低減することにより、高画質の画像で原稿画像を再生する画像処理装置およびディジタルカラー複写機を提供することを目的とする。

【００１８】

【課題を解決するための手段】上記目的を達成するため本発明は、黒で印刷された黒文字を含むカラー原稿を読みとり走査して得た複数の色信号から、前記黒文字の内部領域である第１の領域を検出する第１の検出手段と、前記黒文字のエッジ領域である第２の領域を検出する第２の検出手段と、前記黒文字以外の色文字の領域である第３の領域を検出する第３の検出手段を備えることを特徴とする。

【００１９】

【発明の実施の形態】図４は本発明の実施の形態におけるディジタルカラー複写機の信号処理のブロック図である。

【００２０】図４において、２１は、原稿を走査して原稿の画像情報を読み取るライン型のカラーイメージセンサである。２２は、イメージセンサ２１からの色分解されたレッド、グリーン、ブルーに対応する画像信号Ｒ、Ｇ、Ｂを増幅する増幅器で、増幅された画像信号Ｒ′，Ｇ′，Ｂ′を出力する。２３は、アナログ量である画像信号Ｒ′，Ｇ′，Ｂ′をディジタルに変換するＡ／Ｄコンバータである。２４は、イメージセンサ２１の画像読み取り時のシェーディング歪を補正するシェーディング補正回路である。シェーディング補正回路２４は、Ａ／Ｄコンバータの出力Ｒｄ，Ｇｄ，Ｂｄ入力とし、シェーディング補正処理した画像信号Ｒ″，Ｇ″，Ｂ″を出力する。２５は濃度変換回路であり、反射率スケールの画像信号Ｒ″，Ｇ″，Ｂ″を濃度スケールの画像信号Ｃ，Ｍ，Ｙに変換する。画像信号Ｃ，Ｍ，Ｙはシアン、イエロー、マゼンタの色信号に対応する。２６はラインメモリ回路であり、エッジ強調回路２７，単色信号エッジ強調回路５７および領域識別回路２８で５×５画素のウィンドウ処理を行なうためのライン遅延用である。ラインメモリ回路２６は、濃度画像信号Ｃ，Ｍ，Ｙをそれぞれ１ライン遅延した信号、２ライン遅延した信号、３ライン遅延した信号、４ライン遅延した信号及び遅延のない色毎の信号４１、４２、４３を出力する。エッジ強調回路２７は、ラインメモリの出力４１，４２，４３を入力とし、注目画素信号をそれぞれエッジ強調した信号Ｅｃ，Ｅｍ，Ｅｙを出力する。

【００２１】単色信号エッジ強調回路５７は、ラインメモリの出力４１，４２，４３から単色信号を合成し、エッジ強調して信号Ｅｔ４４を出力する。

【００２２】領域識別回路２８は、最大グレー濃度とすべき領域の検出信号Ｂ、無彩色であるべき領域の検出信号Ｎおよびエッジ強調量を他の領域より大きくする領域の検出信号Ｅを出力する。検出信号Ｅは、エッジ強調回路２７および単色信号エッジ強調回路５７に入力され検出信号がＨＩになるとエッジ強調量が大きくなる。

【００２３】５８は識別処理回路であり、エッジ強調された単色信号Ｅｔ４４を領域検出信号Ｂ，Ｎに従って処理した信号Ｅｔｐ５９を出力する。また識別処理回路５８は、セレクタ３０にセレクト信号ｔ４９を出力する。

【００２４】２９は、エッジ強調信号Ｅｃ，Ｅｍ，Ｅｙの色修正及び黒成分を生成するマスキング回路であり、色修正及び黒生成を行なった画像信号５３　Ｃｍ，５４　Ｍｍ，５５　Ｙｍ，５６　Ｋｍを出力する。

【００２５】３０は、マスキング回路２９が出力する画像信号Ｃｍ，Ｍｍ，Ｙｍ及びＫｍと、識別処理回路５８の出力する信号５９Ｅｔｐのうちから１つを選択し、選択された画像信号Ｓを出力するセレクタである。

【００２６】５０はズーム回路であり、ライン走査方向（主走査方向）のズーミング処理を行なう。ズーム回路は画像信号の補間処理と間引き処理を行なうことによりライン走査方向のズーム機能を実現する。副走査方向のズーミング処理は、画像読み取り装置の副走査速度を変えることにより実現する。例えば、副走査速度を１／２にすると２００％の副走査方向のズーム率となる。

【００２７】３１はガンマ補正回路であり、後述のレーザビームプリンタの階調特性を補正し、ガンマ補正された画像信号Ｓｇを出力する。ガンマ補正回路３１は、メモリを用いたルックアップテーブルによりＤ／Ｄ変換を行なうことにより実現する。３２はディジタル信号である画像信号Ｓｇをアナログ量に変換するＤ／Ａコンバータである。３３は、Ｄ／Ａコンバータ３２から出力されるアナログ量の大きさによりパルス幅変調するパルス幅変調回路である。３４は、パルス幅変調された画像信号により、レーザダイオード３５を駆動するレーザドライバである。３１，３２，３３，３４，３５は周知のレーザビームプリンタを構成する。

【００２８】イメージセンサ２１で読み取られた原稿画像は、レーザビームプリンタで再生される。レーザビームプリンタは、色面順次でシアン、イエロー、マゼンタ、ブラックの色重ねを行いカラー画像を再生する。

【００２９】イメージセンサ２１は原稿画像を４回走査し、セレクタ３０は、レーザビームプリンタで再生する色に対応する画像信号を選択する。ただし、セレクタ３０はＣｍ，Ｍｍ，またはＹｍを選択中にセレクト信号ｔ４９がＨＩになると、信号Ｓを０にする。また、セレクタ３０はＫｍを選択中、セレクト信号ｔ４９がＨＩになると信号５９を選択して出力する。

【００３０】このように、原稿における黒文字領域を判

別し、黒の色材のみで原稿画像を記録材上に再生し、黒の色材のみで黒文字を再現することにより、十分な無彩色度と濃度で黒文字を再現でき、またカラープリンタの色重ね時の位置ずれによって黒文字のエッジ部に色付きが生じることを無くすことができる。

【００３１】図４における濃度変換回路２５について説明する。図５は濃度変換回路の一部のブロック図である。濃度変換回路２５はメモリを用いたルックアップテーブルの手法で実現する。図５において、１３１はメモリ、１３２は、図４の反射率スケールの画像信号R″またはG″またはB″であり、メモリ１３１のアドレスA７～A０に入力される。１３３はメモリから読みだされたデータであり、図４の濃度スケールの画像信号C、M、Yに対応する。濃度変換回路２５は実際には、入力信号R″、G″、B″に対する３つのメモリを有する。１３４は、メモリ１３１のアドレスA１０～A８に入力され、メモリ１３１に記憶されている８種のルックアップテーブルのうち１つを選択する選択信号である。選択信号は複写機を制御する図示していない制御部が設定する。

【００３２】図６は図４におけるメモリ１３１に記憶されているルックアップテーブルのデータの例のグラフである。反射率から濃度に変換するのは反射率の対数を計算することにより得られる。図６におけるルックアップテーブルの曲線の形状を変えることによって、再生画像のコントラスト、濃度のダイナミックレンジなどを変えることができる。図２の場合、８種の異なったルックアップテーブルがメモリ１３１に記憶されており、選択することができる。

【００３３】図７は図４におけるラインメモリ回路２６のブロック図である。１４１，１４２，１４３及び１４４は入力された画像信号を１ライン遅延する１ラインディレイメモリである。図４のラインメモリ回路２６は、濃度画像信号C，M，Yをそれぞれ１ライン遅延した信号、２ライン遅延した信号、３ライン遅延した信号、４ライン遅延した信号及び遅延のない信号４１、４２、４３を出力する。

【００３４】図８は図４におけるエッジ強調回路２７のブロック図である。１０１はエッジ量検出回路であり、遅延ライン数の異なる５つの信号４１を入力とし、注目画素を中心画素とする５×５画素のウインドウで画像信号を走査し、注目画素のエッジ量信号１０４を出力する。１０２はエッジ量変換回路である。エッジ量変換回路１０２は、エッジ量信号１０４をエッジ量の大きさに応じてエッジ信号の大きさを変換し、変換されたエッジ量信号１０５を出力する。

【００３５】１０３はエッジ量加算回路である。エッジ量加算回路１０３は、注目画素の濃度信号１０８と、変換されたエッジ量信号１０５に複数の異なる係数を乗じた値を加算し、加算した値が信号のダイナミックレンジを越えているか否かの示す、飽和状態信号１２７を出力する。またエッジ量制御回路１３０からのエッジ強調量選択信号１２２により前記加算した値の１つを選択し、エッジ強調された信号Ｅｃを出力する。エッジ量検出回路１０１，エッジ量変換回路１０２およびエッジ量加算回路１０３からなる部分は色信号毎にあり、それぞれの色の濃度信号のエッジ成分を増大させたエッジ強調信号Ｅｃ，Ｅｍ，Ｅｙを出力する。

【００３６】エッジ量制御回路１３０は、色信号毎のエッジ量加算回路から出力される飽和状態信号１２７，１２８，１２９および、領域識別回路２８からの検出信号Ｅを入力とし、エッジ強調量選択信号１２２を出力する。

【００３７】図８におけるエッジ量検出回路１０１について図９を用いて説明する。図９はエッジ量検出回路１０１の動作説明図である。

【００３８】遅延ライン数の異なる５つの信号４１を入力とし、注目画素を中心画素とする５×５画素のウインドウで画像信号を走査する。ウィンドウの中央の注目画素のエッジ量を、（注目画素の濃度×２）－（ウィンドウの４隅の画素の濃度×０．５）という演算で求めたエッジ量信号１０４を出力する。

【００３９】次に図１０、図１１および図１２を用いて、図８におけるエッジ量変換回路１０２について説明する。

【００４０】図１０はエッジ量変換回路の変換特性の第１の例を示す図である。エッジ量変換回路に入力されるエッジ量信号の大きさがａより小さいときエッジ量変換回路は０を出力する。入力されるエッジ量信号の大きさがｂより大きいときは入力信号に係数ｋを乗じた値を出力する。入力されるエッジ量信号の大きさがａからｂのときは入力信号に係数ｉを乗じ定数ｃを加算した値を出力する。この時、係数ｉおよび定数ｃは、入力エッジ量信号の大きさがａより小さいときおよびｂより大きいときのエッジ量変換特性と連続になるようにする。

【００４１】図１１はエッジ量変換回路の変換特性の第２の例を示す図ある。エッジ量変換回路に入力されるエッジ量信号の大きさがａより小さいときエッジ量変換回路は０を出力する。入力されるエッジ量信号の大きさがｂより大きいときは入力信号に係数ｋを乗じた値を出力する。入力されるエッジ量信号の大きさがａからｂのときは、図１１に示すような曲線で表わした値を出力する。この時、入力されるエッジ量信号の大きさがａより小さいときおよびｂより大きいときのエッジ量変換特性と連続になるようにする。

【００４２】図１２は図１０、図１１に示す変換特性を実現する図８におけるエッジ量変換回路１０２のブロック図である。７１は、エッジ量信号１０４を入力とし、エッジ量信号の絶対値７５と符号ビット７９を出力する絶対値回路である。７２はメモリであり、エッジ量信号

の絶対値75はメモリ72のアドレスADR8～ADR0に入力される。メモリ72には変換用のルックアップテーブルデータが記憶されている。メモリ72には、図10または図11に示したa，b，kを変えた複数のルックアップテーブルが記憶されており、ルックアップテーブル選択信号78により、そのうち1つのルックアップテーブルが選択される。ルックアップテーブル選択信号78は、メモリ72のアドレスADR11～ADR9に入力され、メモリに記憶されている8種のルックアップテーブルのうち1つを選択する。ルックアップテーブル選択信号は複写機を制御する図示していない制御部が設定する。61がエクスクルーシブオアゲートであり、符号ビット79と制御信号INVを入力とする。制御信号INVは図示していない複写機の制御部が出力する。INVをHIにすると符号ビット79が反転して出力され、結果的に画像信号のエッジ成分の符号が反転するため画像信号をぼかす処理をエッジ強調回路で実現することになる。73は2の補数変換回路であり、ルックアップテーブルによって変換された正の値76と符号ビットより、2の補数で表わした変換されたエッジ量信号105を出力する。

【0043】図10，図11におけるaの値の異なった複数のルックアップテーブルを用意しておくことにより、エッジ強調処理による画像信号中のノイズ成分の増長の抑圧量を可変できる。係数kの値を異なった複数のルックアップテーブルを用意しておくことにより、エッジ強調量を可変できる。更に、bの値を異なった複数のルックアップテーブルを用意しておくことにより、エッジ強調量に連続性を変えることができる。図12においてメモリ72は、少なくとも1つのエッジ量変換用のルックアップテーブルを記憶できる書込み可能なメモリで構成し、変換特性を変えるときは、複写機を制御する図示していない制御部がルックアップテーブルデータを書き込んでもよい。また、図10に示すように変換特性が折れ線である時はメモリを用いたルックアップテーブルではなく、乗算器、加算器等を用いて図10の変換特性を実現してもよい。

【0044】エッジ量加算回路103を説明する前に、エッジ強調処理によって色細線や色エッジが無彩色化する現象について説明する。

【0045】図13は、白地上の青色の細線をイメージスキャナで読み取ったときの色分解された8ビットのR，G，B濃度データを示すグラフである。位置dではR，Gに比べてBの濃度が大きいので位置dでの色は青である。

【0046】図14は図13に示した濃度データにエッジ強調処理をした後のデータである。位置d'ではエッジ強調処理により濃度信号のダイナミックレンジを越えるため、R，G，Bデータはともに255となり黒になってしまう。このように、エッジ強調処理によりエッジ強調後の画像信号が、信号のダイナミックレンジを越える場合、色信号が無彩色化する。

【0047】次に図8に示したエッジ量加算回路103及びエッジ量制御回路130について、図15を用いて説明する。

【0048】第15図は、エッジ量加算回路103およびエッジ量制御回路130のブロック図である。

【0049】103はエッジ量加算回路である。105は変換されたエッジ量信号、108は注目画素の画像信号である。81は、変換されたエッジ量信号105の2倍の値を出力する2倍演算器、82は1／2倍演算器、83は1／倍演算器である。各演算器はビットシフトで実現できる。84は2倍演算器101の出力と注目画像信号を加算器であり、加算した値が8ビットで表現可能な0～255のダイナミックレンジを越えるとき飽和状態信号123をHIにして出力する。加算器85，86および87も同様にそれぞれ飽和状態信号124，125および126を出力する。セレクタ108は、エッジ強調量選択信号122に基づいて、各加算器の出力84，85，86，87および注目画素信号108をそれぞれi4，i3，i2，i1，i0入力とし、入力の内1つを選択し、エッジ強調された画像信号Ecを出力する。演算器群、加算器群、セレクタよりなるエッジ強調量選択回路は色信号毎に3つあり、それぞれエッジ強調された信号Ec，Em，Eyを出力する。図8の飽和状態信号127は、図15の飽和状態信号123，124，125および126をまとめて表示している。

【0050】130は、エッジ量制御回路である。109，110，111および112はオアゲートであり、色毎の飽和状態信号信号を入力とし、信号118，119，120および121を出力する。113はプライオリティーエンコーダであり、オアゲートの出力118，119，120，121をそれぞれI1，I2，I3，I4入力とする。さらに、エッジ強調量を他の領域より大きくすべき領域の検出信号Eも入力とし、エッジ強調量選択信号122を出力する。EがHIの場合、プライオリティーエンコーダ113は、入力In（nは1～4）のうち最も大きいnでかつInがLOWのとき、セレクタ108が入力in（nは1～4）を選択するようにエッジ量選択信号122を出力する。EがLOWの場合、プライオリティーエンコーダ113は、入力In（nは1～3）のうち最も大きいnでかつInがLOWのとき、セレクタ108が入力in（nは1～3）を選択するエッジ量選択信号122を出力する。プライオリティーエンコーダの入力Inがすべて HIのときは、Eに関わらず、プライオリティーエンコーダ113はセレクタ108が入力i0を選択するエッジ量選択信号を122を出力する。

【0051】図16に、プライオリティーエンコーダ113の入力と、セレクタ108の選択する選択信号の図

を示す。

【0052】以上のようにエッジ強調後の信号が、画像信号のダイナミックレンジを越えないようにエッジ強調量を抑圧することにより、色細線や色エッジの無彩色化を防止できる。特に、色細線が多い地図原稿等の場合、エッジ強調量を多くして複写する方がよいが、このとき色細線が黒線として再生してしまうことを防止できる。

【0053】図17は図4における単色信号エッジ強調回路57のブロック図である。271，272，273，274および275は色信号合成回路であり、それぞれライン遅延数の異なるC，M，Y信号（41，42，43）を入力とし、1つの合成された単色信号を出力する。例えば、a・C+b・M+c・Y（a，b，cは所定の係数）で算出する。エッジ量検出回路276は、図8のエッジ量検出回路101と同じであり、前記単色信号を5×5のウインドウで走査しエッジ量信号277を出力する。エッジ量変換回路278は、図8のエッジ量変換回路102と同様であり、エッジ量信号277を変換した信号279を出力する。エッジ量変換回路280は、EがLOWのとき、変換されたエッジ量信号279と注目画素の単色信号281を加算し、EがHIのとき、変換されたエッジ量信号279の2倍と注目画素の単色信号281を加算し、エッジ強調した単色信号Et44を出力する。

【0054】図18は、図4における領域識別回路28のブロック図である。91は、最大グレー濃度領域検出回路であり、色毎の遅延ライン数の異なる信号41、42、43を入力とし、最大グレー濃度領域検出信号Bと、無彩色判定信号98を出力する。92は、無彩色領域識別回路およびエッジ強調増大領域検出回路であり、色毎の遅延ライン数の異なる信号41、42、43および無彩色判定信号98を入力とし、無彩色領域検出信号Nと、エッジ強調増大領域検出信号Eを出力する。

【0055】図19は、図18における最大グレー濃度領域検出回路91のブロック図である。229，230，231，232，233は、それぞれ遅延ライン数の異なるC，M，Y濃度信号である。201は単色化回路であり、C，M，Y濃度信号を入力とし、1つの濃度に対応する単色信号211を合成して出力する。単色化回路は異なる遅延ライン数の信号毎に5つあり、それぞれ遅延ライン数の異なる単色信号211，212，213，214，215を出力する。

【0056】202は5×5ウインドウ処理回路1であり、前記単色信号を5×5画素で走査し、5×5ウインドウ処理1した信号216を出力する。

【0057】203，204，205は3×3ウインドウ処理回路1であり、前記単色信号を3×3画素で走査し、それぞれ、3×3ウインドウ処理1した1ビットの信号217，218，219を出力する。3×3ウインドウ処理回路1　203は、単色信号211，212，213を入力とし、3×3ウインドウ処理回路1　204は、単色信号212，213，214を入力とし、3×3ウインドウ処理回路1　205は、単色信号213，214，215を入力とし、遅延ライン数の異なる3×3ウインドウ処理1した信号217，218，219をそれぞれ出力する。206は3×3連続点近傍処理回路であり、遅延ライン数の異なる3×3ウインドウ処理した信号217，218，219を、3×3画素ウインドウで走査し、3×3画素のウインドウ内の9画素に、2つ以上連続したの画素があるとき、3×3連続点近傍処理された1ビットの信号220をHIにする。

【0058】208は無彩色検出回路であり、1ライン遅延したC，M，Y濃度信号232を入力とし、C，M，Yのうち最も大きい値と最も小さい値の差が所定の値以下である時、無彩色検出信号221をHIにする。2ライン遅延したC，M，Y濃度信号232より無彩色検出を行なった信号が無彩色検出信号222であり、3ライン遅延したC，M，Y濃度信号232より無彩色検出を行なった信号が無彩色検出信号223である。

【0059】209は3×3近傍処理回路であり、遅延ライン数の異なった無彩色検出信号221，222，223を入力とし、3×3画素のウインドウで無彩色検出信号を走査し、3×3画素ウインドウ内の9画素全ての無彩色判定信号がHIであるとき、無彩色判定信号98をHIにする。

【0060】207はアンドゲートであり、5×5ウインドウ処理1された信号216，3×3連続点近傍処理された信号220と、無彩色判定信号98の論理和を演算し、最大グレー濃度領域Bを出力する。

【0061】図20は、図19における5×5ウインドウ処理回路1の202のブロック図である。

【0062】570は5×5エッジ検出回路であり、遅延ライン数の異なる単色信号211，212，213，214，215を入力とし、前記単色信号を5×5画素のウインドウで走査して、5×5エッジ検出信号577と5×5エッジ成分信号575を出力する。ここで5×5画素のウインドウの中央が注目画素である。

【0063】571は、5×5濃度検出回路であり、5×5エッジ成分信号と単色信号213を入力とし、注目画素の濃度検出信号576を出力する。

【0064】572は5×5濃度差検出回路であり、遅延ライン数の異なる単色信号211，212，213，214，215を入力とし、前記単色信号を5×5画素のウインドウで走査して、画素ウインドウ内の5×5濃度差検出信号578を出力する。

【0065】574はアンドゲートであり、5×5エッジ検出信号577、5×5濃度検出信号576および5×5濃度差遺出信号578の論理和を演算し、5×5ウインドウ処理1された信号216を出力する。

【0066】図21は、図20における5×5エッジ検

出回路５７０のブロック図である。５８０は5×5ウインドウ演算器であり、遅延ライン数の異なる単色信号２１１，２１２，２１３，２１４，２１５を入力とし、前記単色信号を５×５画素のウインドウで走査する。前記５×５のウインドウの中央の画素データから、4隅の画素の値を1／4した値の和を加算することにより、５×５エッジ成分信号５７５を出力する。５８１はコンパレータであり、前記５×５エッジ信号５７５と、図示していない複写機の制御部が設定する所定の閾値５８２とを比較し、５×５エッジ成分５７５が前記所定の閾値５８２より大きいときＨＩとなる５×５エッジ検出５７５を出力する。

【００６７】図２２は、図２０における５×５濃度検出回路５７１のブロック図である。２９１は加算器であり、５×５エッジ成分信号５７５と注目画素の単色信号２１３を加算し、エッジ成分加算信号２９４を出力する。２９２はコンパレータであり前記エッジ成分加算信号２９４と、図示していない複写機の制御部が設定する所定の閾値２９３とを比較し、エッジ成分加算信号２９４が前記所定の閾値２９３より大きいときＨＩとなる５×５エッジ検出５７６を出力する。

【００６８】図２３は、図２０における５×５濃度差検出回路５７２のブロック図である。３０１は5×5濃度差演算器であり、遅延ライン数の異なる単色信号２１１，２１２，２１３，２１４，２１５を入力とし、前記単色信号を５×５画素のウインドウで走査し、５×５のウインドウ内の図に示す印をした画素の最大値と最小値の差を演算し、５×５濃度差信号３０５を出力する。ここで注目画素は５×５のウインドウの中央の画素である。３０２はコンパレータであり、注目画素の単色濃度差信号３０５と、図示していない複写機の制御部が設定する所定の閾値３１０を比較し、注目画素の濃度差信号３０５が所定の値３１０より大きいときＨＩとする信号５７８を出力する。

【００６９】図２４は、図１９における３×３ウインドウ処理回路１　２０５のブロック図である。

【００７０】３２０は3×3エッジ検出回路であり、遅延ライン数の異なる単色信号２１３，２１４，２１５を入力とし、前記単色信号を３×３画素のウインドウで走査して、3×3エッジ検出信号３２５を出力する。ここで3×3画素のウインドウの中央が注目画素である。

【００７１】３２１は濃度検出回路であり、単色信号２１３を入力とし、注目画素の濃度検出信号３２６を出力する。

【００７２】３２３は3×3濃度差検出信号であり、遅延ライン数の異なる単色信号２１３，２１４，２１５を入力とし、前記単色信号を３×３画素のウインドウで走査して、画素ウインドウ内の3×3濃度差検出信号３２７を出力する。

【００７３】３２４はアンドゲートであり、3×3エッジ検出信号３２５、濃度検出信号３２６および3×3濃度差検出信号３２７の論理和を演算し、3×3ウインドウ処理1された信号２１９を出力する。

【００７４】図２５は図２４における3×3エッジ検出回路３２０のブロック図である。３３０は3×3ウインドウ演算器であり、遅延ライン数の異なる単色信号２１３，２１４，２１５を入力とし、前記単色信号を3×3画素のウインドウで走査する。前記3×3ウインドウの注目画素からウインドウの4隅の画素を1／4した値の和を加算することにより、3×3エッジ成分信号３３３を出力する。３３１はコンパレータであり、前記3×3エッジ成分信号３３３と、図示していない複写機の制御部が設定する所定の閾値３３２とを比較し、3×3エッジ成分信号３３３が前記所定の閾値より大きいときＨＩになる3×3エッジ検出信号３２５を出力する。

【００７５】図２６は、図２４における濃度検出回路３２１のブロック図である。３４０はコンパレータであり、注目画素の単色信号２１４と、図示していない複写機の制御部が設定する所定の閾値３４１とを比較し、注目画素の単色信号２１４が所定の閾値より小さいときＨＩとなる濃度検出信号３２６を出力する。

【００７６】図２７は、図２４における3×3濃度差検出回路のブロック図である。３５０は3×3濃度差演算器であり、遅延ライン数の異なる単色信号２１３，２１４，２１５を入力とし、前記単色信号を3×3画素のウインドウで走査する。前記3×3ウインドウの内の図中の印をした画素の最大値と最小値の差を演算し、3×3濃度差信号３５３を出力する。３５２はコンパレータであり、前記3×3濃度差信号３５３と、図示していない複写機の制御部が設定する所定の閾値３５４とを比較し、3×3濃度差信号３５３が前記所定の閾値より大きいときＨＩになる3×3濃度差検出信号３２７を出力する。

【００７７】図１８の最大グレー濃度領域検出回路９１を以上のような構成で実現し、格式位置を最適に設定することのより、注目画素のエッジ強調後の濃度、５×５画素ウインドウでのエッジ成分、3×3画素ウインドウでのエッジの連続性および注目画素近傍の無彩色画素の情報より、最大グレー濃度とすべき領域を検出するので、誤検出をきわめて少なくすることができる。

【００７８】次に、図１８の無彩色領域検出回路およびエッジ強調増大領域検出回路９２について説明する。

【００７９】図２８は、図１８における無彩色領域検出回路およびエッジ強調増大領域検出回路９２のブロック図である。２２９，２３０，２３１，２３２，２３３は、それぞれ遅延ライン数の異なるＣ，Ｍ，Ｙ濃度信号である。２３９は最淡色選択回路であり、Ｃ，Ｍ，Ｙ濃度信号を入力とし、最も大きい値の信号を選択し、1つの最淡色信号２５１を出力する。最淡色選択回路は異なる遅延ライン数の信号毎に5つあり、それぞれ遅延ライ

ン数の異なる最淡色信号251，252，253，254，255を出力する。

【0080】240は5×5ウインドウ処理回路2　240であり、前記最淡色信号を5×5画素で走査し、5×5ウインドウ処理2した信号256を出力する。

【0081】241，242，243は3×3ウインドウ処理回路2であり、前記最淡色信号を3×3画素で走査し、それぞれ、3×3ウインドウ処理2した1ビットの信号258，259，260を出力する。3×3ウインドウ処理回路2　241は、最淡色信号251，252，253を入力とし、3×3ウインドウ処理回路242は、最淡色信号252，253，254を入力とし、3×3ウインドウ処理回路2　243は、最淡色信号213，214，215を入力とし、遅延ライン数の異なる3×3ウインドウ処理2した信号258，259，260をそれぞれ出力する。244は3×3連続点近傍処理回路であり、遅延ライン数の異なる3×3ウインドウ処理2した信号258，259，260を、3×3画素ウインドウで走査し、3×3画素のウインドウ内の9画素に、2つ以上連続したの画素があるとき、3×3連続点近傍処理された1ビットの信号261をHIにする。245はアンドゲートであり、5×5ウインドウ処理2をされた信号256，3×3連続点近傍処理された信号261と、無彩色判定信号98の論理和を演算し、無彩色領域検出信号Nを出力する。

【0082】246はアンドゲートであり、5×5ウインドウ処理2をされた信号256，3×3連続点近傍処理された信号261の論理和を演算し、エッジ強調増大領域検出信号Eを出力する。

【0083】図29は、図28における5×5ウインドウ処理回路2　240のブロック図である。

【0084】361は5×5濃度差演算器であり、遅延ライン数の異なる最淡色信号251，252，253，254，255を入力とし、前記最淡色信号を5×5画素のウインドウで走査し、5×5のウインドウ内の図に示す印をした画素の最大値と最小値の差を演算し、5×5最淡色濃度差信号363を出力する。ここで注目画素は5×5のウインドウの中央の画素である。362はコンパレータであり、注目画素の最淡色濃度差信号363と、図示していない複写機の制御部が設定する所定の閾値364を比較し、注目画素の単色濃度差信号363が所定の値364より大きいときHIとする5×5ウインドウ処理2した信号256を出力する。

【0085】図30は、図28における3×3ウインドウ処理回路（2）243のブロック図である。

【0086】378，379および380は最大値クリップ回路であり、最淡色信号253，254，255をそれぞれ入力とする。前記最大値クリップ回路378，379，380は、入力信号を、複写機の制御部が設定する最大値でクリップし、クリップされた単色信号374，375，376をそれぞれ出力する。最大値クリップ回路379は、注目画素がクリップされたときHIになるクリップ検出信号377を出力する。

【0087】370は3×3ウインドウ演算器であり、遅延ライン数の異なるクリップされた最淡色信号374，375，376を入力とし、クリップされた最淡色信号を3×3画素のウインドウで走査して、3×3エッジ成分信号373を出力する。ここで、3×3画素のウインドウの中央の画素が注目画素である。

【0088】371はコンパレータであり、前記3×3エッジ成分信号373と、図示していない複写機の制御部が設定する所定の閾値372とを比較し、3×3エッジ成分信号373が前記所定の値より大きいときHIとなる信号378を出力する。

【0089】381はアンドゲートであり、コンパレータ371の出力378とクリップ検出信号377の論理和を演算し、3×3ウインドウ処理2した信号260を出力する。

【0090】図18の無彩色領域検出回路およびエッジ強調増大領域検出回路92を、以上に示したような構成で実現し、各閾値を最適に設定することにより、5×5画素ウインドウ処理での最淡色信号の濃度差、注目画素近傍の3×3画素ウインドウ処理での最大値をクリップした信号のエッジ成分、および注目画素近傍の無彩色画素の情報から無彩色領域領域およびエッジ強調増大領域を検出するので誤識別がきわめて少なくでき、3×3ウインドウ処理でクリップした信号を用いることにより、黒文字周辺の淡い部分から少し濃い部分への変化領域を検出できる。

【0091】図31を用いて、最大グレー濃度領域検出、無彩色領域検出およびエッジ強調増大領域検出が画像のどの様な領域を検出するかを説明する。

【0092】図31は領域検出領域を示す図である。図31の濃度曲線は左から右へ低濃度領域から高濃度領域への変化を示しており、高濃度領域は黒文字であるとする。Aの領域は、最大グレー濃度であるべき最大グレー濃度領域と検出され、Bの領域は無彩色であるべき無彩色領域もしくはエッジ強調を他の領域より大きくすべきエッジ強調増大領域である。画像信号が無彩色と判定すればBの領域は無彩色領域と判定する。すなわち、原稿の下地に色がついている場合の黒文字のエッジ部は、エッジ強調増大領域として検出する。

【0093】図32は、図4における識別処理回路58のブロック図である。400は2値化回路であり、エッジ強調された単色信号Et44を2値化して2値化単色信号404を出力する。セレクタ401は、無彩色領域検出信号NがHIのとき2値化単色信号404を選択し、NがLOWのときエッジ強調された単色信号44を選択して信号405を出力する。セレクタ402は、最大グレー濃度領域検出信号BがHIのき最大濃度データ

ｆｆＨを選択し、ＢがＬＯＷのときセレクタ４０１の出力４０５を選択して信号Ｅｔｐを出力する。４０３はオアゲートであり、最大グレー濃度領域検出信号Ｂと無彩色領域検出信号Ｎを入力とし、セレクト信号ｔ４９を出力する。セレクト信号ｔ４９は、黒の色材のみで再生する領域を示す信号である。セレクタ４０２を削除し、オアゲート４０３の出力ｔをセレクタ４０１のセレクト入力ＳＡに入力してもよい。なぜなら最大グレー濃度領域と検出した領域は、ある程度濃度が大きいので２値化回路４００で２値化すると、最大グレー濃度の信号になるからである。

【００９４】図３３は、図３２における２値化回路４００の第１の実施例の図である。４１０はコンパレータであり、エッジ強調された単色信号４４と、図示していない複写機の制御部が設定する所定の閾値４１１とを比較し、エッジ強調された単色信号４４の方が閾値より大きいときＨＩになる信号４０４を出力する。信号４１２は８ビットに拡張され、０またはｆｆＨの値になる。

【００９５】図３４は、図３２における２値化回路４００の第２の実施例の図である。４２０はメモリであり、エッジ強調された単色信号４４はメモリ４４のアドレスＡ７～Ａ０に入力される。エッジ強調された単色信号４４は、メモリ４２０に記憶されたルックアップテーブルデータによりＤ／Ｄ変換される。メモリ４２０はデータ読みだし端子ＤＡＴＡ７～ＤＡＴＡ０よりＤ／Ｄ変換された信号４０４を出力する。図示していない複写機の制御部が設定するルックアップテーブル選択信号４２１は、メモリ４２０のアドレスＡ１０～Ａ８に入力され、メモリ４２０に記憶された８つのルックアップテーブルデータのうち１つを選択する。

【００９６】図３５は、図３４のメモリ４２０に記憶されているルックアップテーブルのデータの例を示す図である。

【００９７】図中、傾きｙを９０°とすると、閾値をｘとする２値化回路と等価である。傾きｙを９０°以下にすることは急峻なコントラスト変換を行なうということである。このコントラスト変換を閾値ｘの疑似２値化処理と称する。傾きｙを９０°近くに設定すると、第４図に示すＺＯＯＭ回路５０により拡大処理をしたとき、再生画像のエッジがギザギザになるジャギーが発生する。このため拡大率に応じて傾きｙを小さくして、いわゆるジャギーの発生を抑圧する。メモリ４００がＲＯＭの場合は、傾きｙや閾値ｘを変えた複数のルックアップテーブルをメモリの記憶しておき、最適なルックアップテーブルを選択する。メモリ４００がＲＡＭの場合は、最適なルックアップテーブルデータを外部よりダウンロードする。ルックアップテーブルデータは、図３５の様な折れ線ではなく、曲線であってもよい。

【００９８】次に図４におけるマスキング回路２９について、図３６を用いて説明する。図３６はマスキング回路２９のブロック図である。図３６において、４３１はマトリックス演算回路であり、エッジ強調された画像信号Ｅｃ，Ｅｍ，Ｅｙを入力として、色修正処理された画像信号５３Ｃｍ，５４Ｍｍ，５５Ｙｍを出力する。マトリクス演算回路は以下の演算を行なう。

【００９９】

$$Cm = a11 \cdot Ec + a12 \cdot Em + a13 \cdot Ey$$

$$Mm = a21 \cdot Ec + a22 \cdot Em + a23 \cdot Ey$$

$$Cm = a31 \cdot Ec + a32 \cdot Em + a33 \cdot Ey$$

上式でａｍｎ（ｍ，ｎは１～３）は色修正のための係数である。このマスキング処理方法は周知の１次マスキング法である。４３２は最小値検出回路であり、色修正処理された画像信号５３Ｃｍ，５４Ｍｍ，５５Ｙｍのうち、最も小さい値４３３を出力する。４３５は減算器であり、最小値検出回路４３２からの信号４３３から所定の値４３７Ｓｑを減算した値４４１を出力する。また減算器４３５は、減算した値が負のときアクティブになる符号信号４３６も出力する。４３９はセレクタであり、減算器４３５から出力される符号信号によって、減算器４３５の出力と０の値４３８のうち一方を選択し、黒成分信号５６Ｋｍを出力する。セレクタ４３９は、符号信号４３６が負であるとき４３８（値は０）を選択する。所定の値１３７Ｓｑはスケルトンレベルといわれ、この方法による黒成分生成方法は、周知のスケルトンブラック法である。

【０１００】

【発明の効果】以上のように本実施の形態によれば、原稿画像の黒文字部以外の領域の２値画像領域として識別する誤識別を低減し、かつエッジ成分の少ない黒文字部も識別できる。

【０１０１】さらに、本実施の形態のディジタルカラー複写機は、原稿の黒文字部は黒の色材のみで再現し、黒文字を十分な濃度でシャープに再現し、さらに、プリンタの色重ねに位置ずれがあったときも黒文字エッジ部の色づきが発生しないことにより、高画質の画像で原稿画像を再生し、黒文字部の再生画像の品位を向上させることができる。

【図面の簡単な説明】

【図１】従来のディジタル複写機の信号処理ブロック図

【図２】従来のエッジ強調回路の演算方法の図

【図３】従来の領域識別処理回路のブロック図

【図４】本発明の実施例におけるディジタルカラー複写機の信号処理ブロック図

【図５】濃度変換回路のブロック図

【図６】ルックアップテーブルデータの図

【図７】ラインメモリ回路のブロック図

【図８】エッジ強調回路のブロック図

【図９】エッジ量検出回路のブロック図

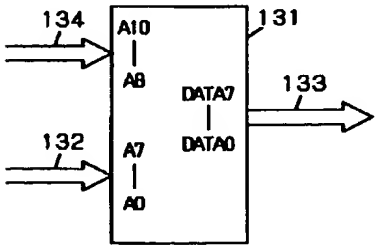
【図１０】エッジ量変換回路の第１の変換特性図

【図１１】エッジ量変換回路の第２の変換特性図

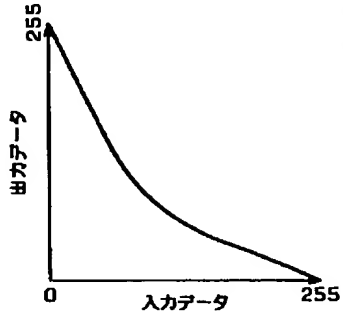
【図12】エッジ量変換回路のブロック図
【図13】青色細線の濃度データの図
【図14】青色細線のエッジ強調処理後の濃度データの図
【図15】エッジ量加算回路のブロック図
【図16】プライオリティーエンコーダの入力とセレクタの選択信号の関係図
【図17】単色信号エッジ強調回路のブロック図
【図18】領域識別回路のブロック図
【図19】最大グレー濃度領域検出回路のブロック図
【図20】5×5ウインドウ処理回路1のブロック図
【図21】5×5エッジ検出回路のブロック図
【図22】5×5濃度検出回路のブロック図
【図23】5×5濃度差検出回路のブロック図
【図24】3×3ウインドウ処理1のブロック図
【図25】3×3エッジ検出回路のブロック図
【図26】濃度検出回路のブロック図
【図27】3×3濃度差検出回路のブロック図
【図28】無彩色領域検出回路及びエッジ強調増大領域検出回路のブロック図
【図29】5×5ウインドウ処理回路2のブロック図
【図30】3×3ウインドウ処理回路2のブロック図
【図31】領域検出領域を示す図
【図32】領域識別回路のブロック図
【図33】2値化回路の第1の実施例の図
【図34】2値化回路の第2の施例の図
【図35】メモリ400に記憶されるルックアップテーブルデータの図
【図36】マスキング処理回路29のブロック図

【符号の説明】
27　エッジ強調回路
28　領域識別回路
30　セレクタ
57　単色信号エッジ強調回路
58　識別処理回路
102　エッジ量変換回路
103　エッジ量加算回路
130　エッジ制御回路
71　絶対値回路
72　メモリ
113　プライオリティエンコーダ
202　5×5ウインドウ処理回路1
203，204，205　3×3ウインドウ処理回路1
206　連続点近傍処理回路
208　無彩色検出回路
209　3×3近傍処理回路
239　最淡色選択回路
378，279，280　最大値クリップ回路
400　2値化回路
401，402　セレクタ
420　メモリ

【図2】



【図3】



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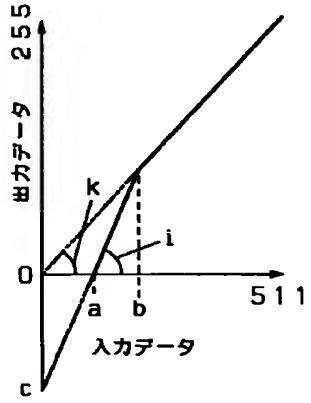
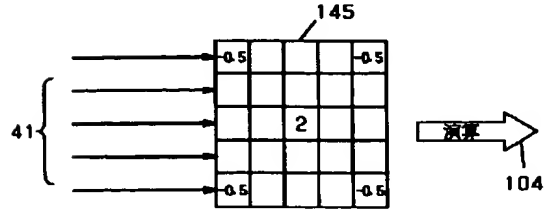
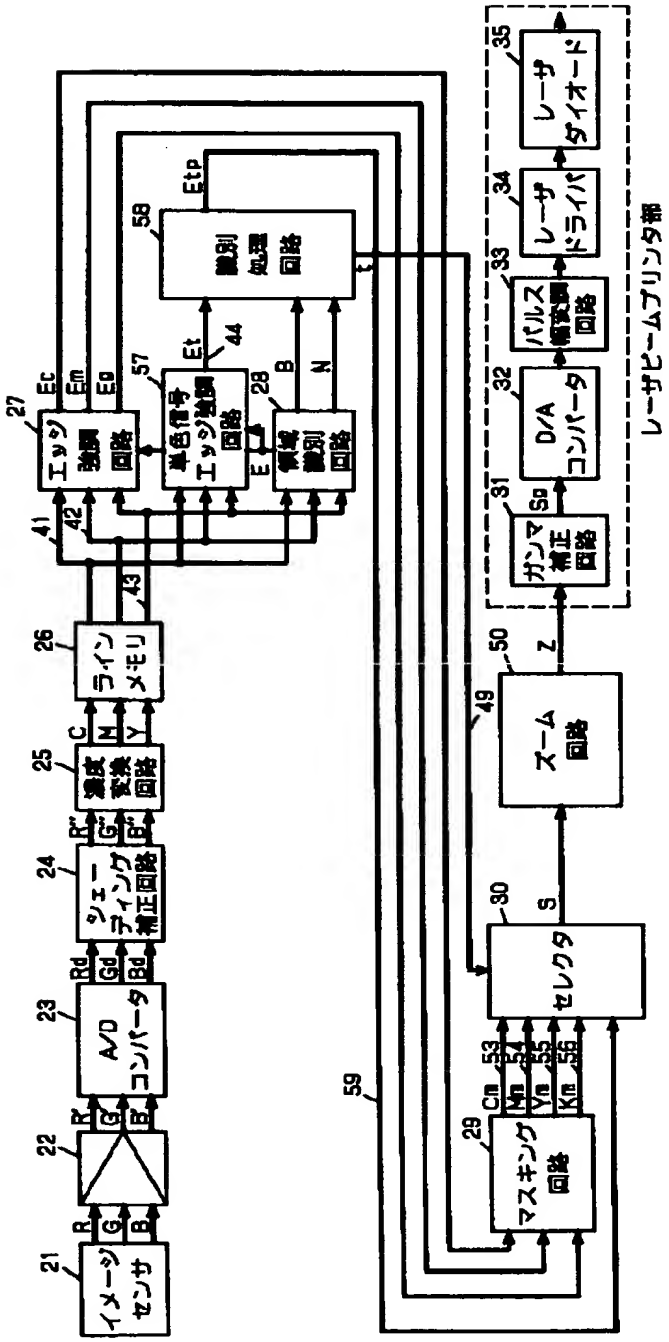


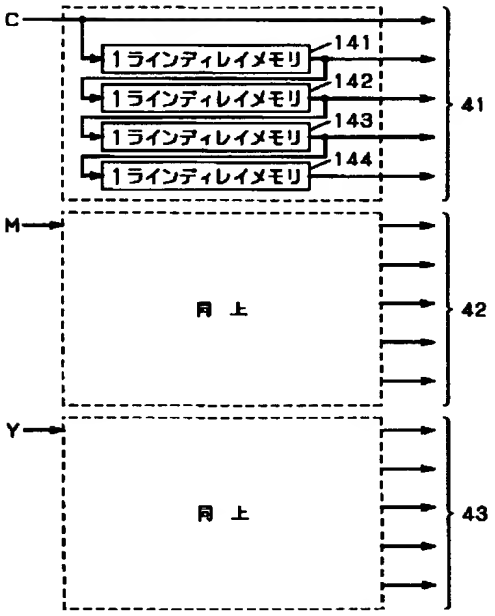
【図6】



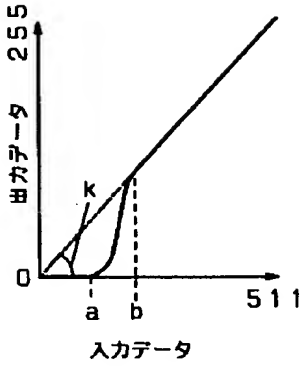
【図1】


レーザビームプリンタ部
イメージセンサ
A/Dコンバータ
シェーディング補正回路
濃度変換回路
ラインメモリ
エッジ強調回路
単色信号エッジ強調回路
識別処理回路
識別回路
ガンマ補正回路
D/Aコンバータ
パルス幅変調回路
レーザドライバ
レーザダイオード
ズーム回路
セレクタ
マスキング回路

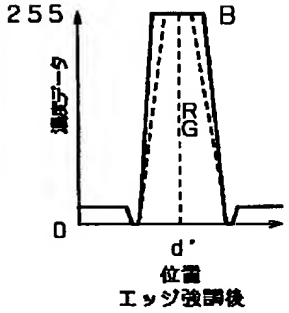
【図4】



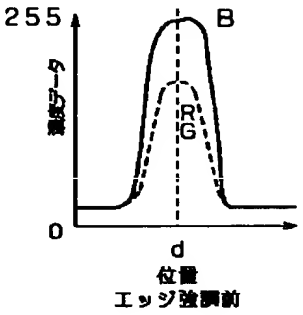
【図8】



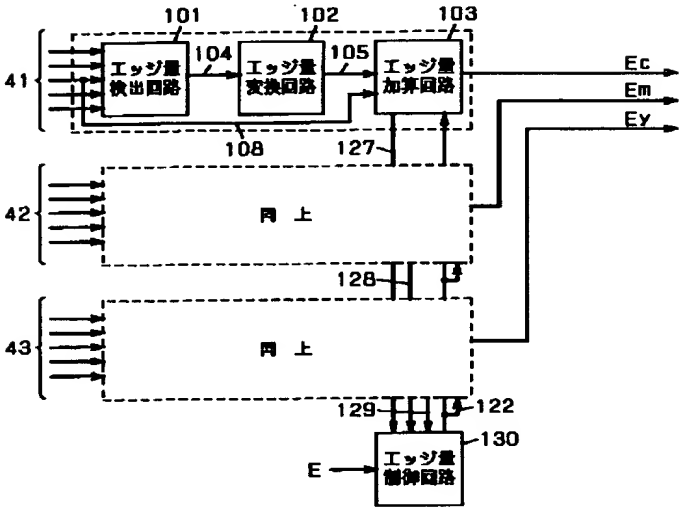
【図11】



【図10】



【図5】

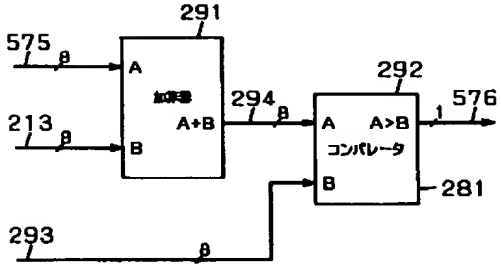


【図13】

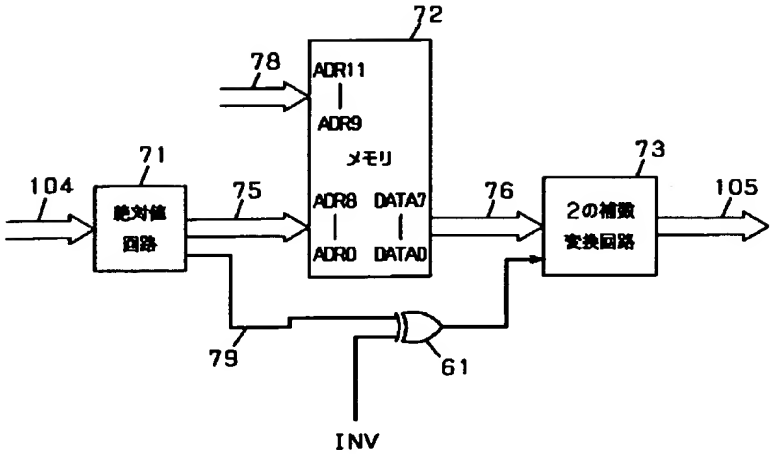
H:HI
L:LOW
X:don't carl

E	I4	I3	I2	I1	Selected
H	L	L	L	L	14
H	H	H	H	L	11
H	H	H	L	L	12
H	H	L	L	L	13
H	H	H	H	H	10
L	X	L	L	L	13
L	X	H	H	L	11
L	X	H	L	L	12
L	X	H	H	H	10

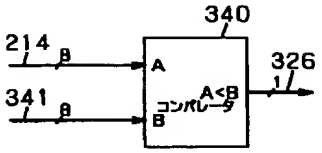
【図19】



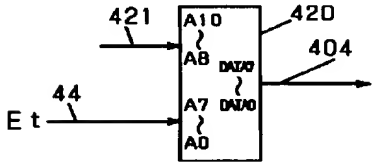
【図9】



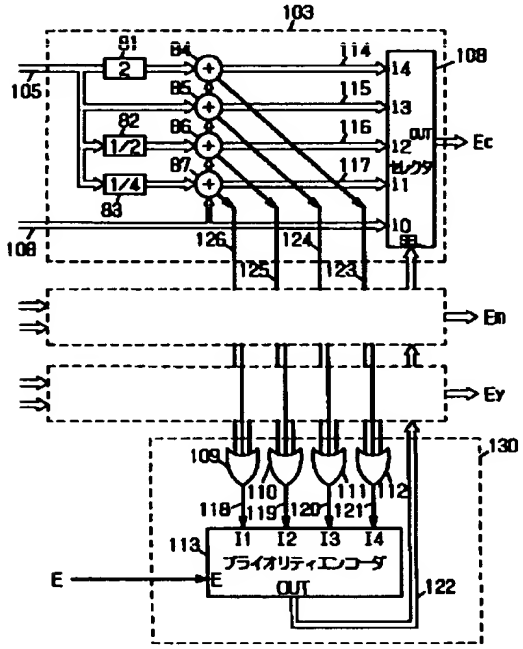
【図23】



【図31】



【図12】



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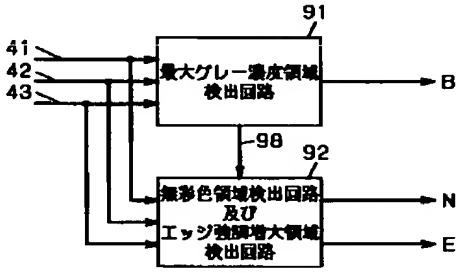

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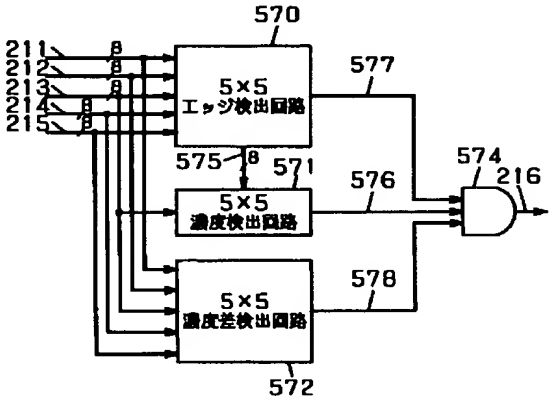
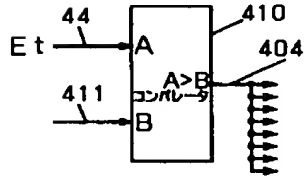
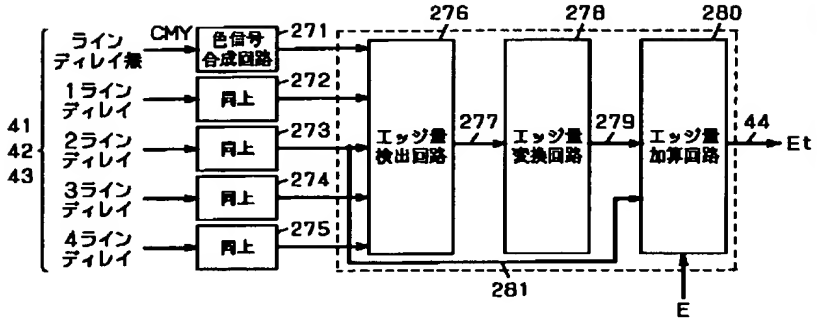


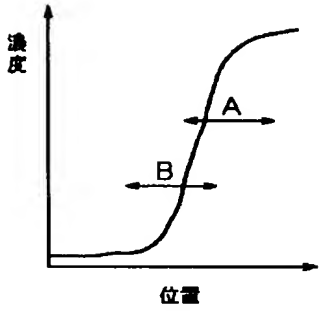
【図30】



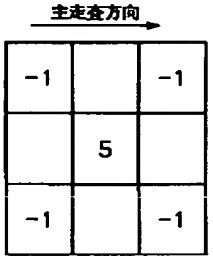
【図14】



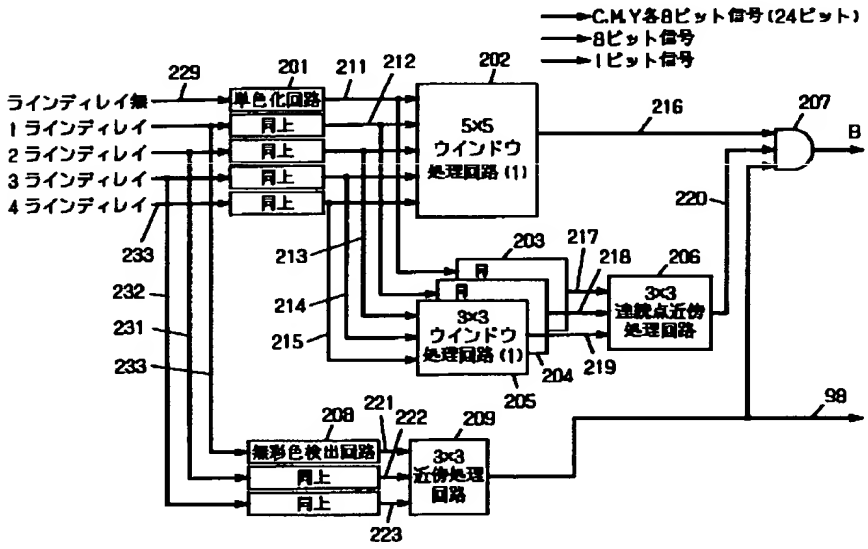
【図28】



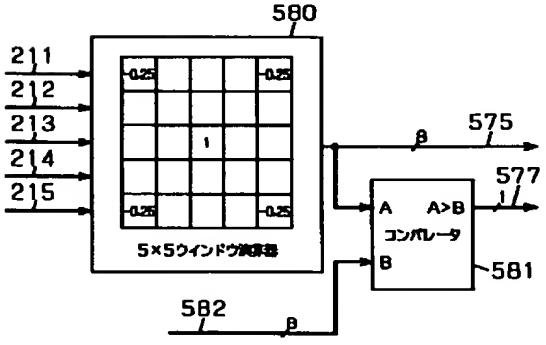
【図35】



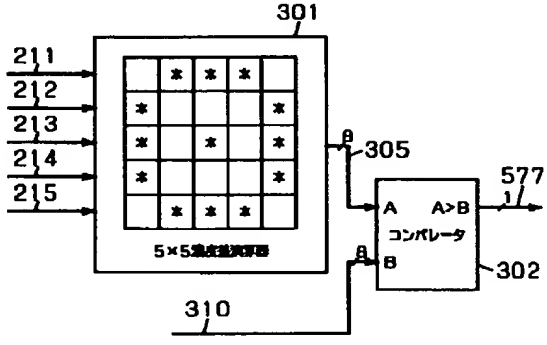
【図16】



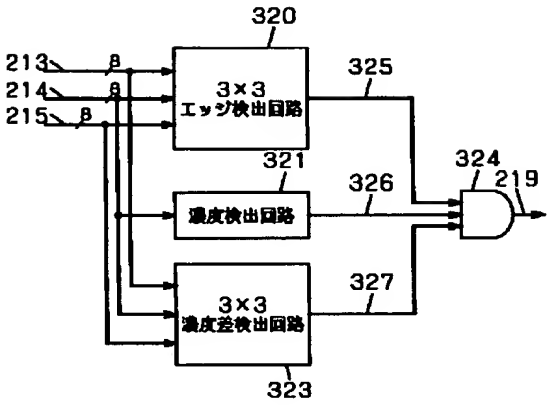
【図18】



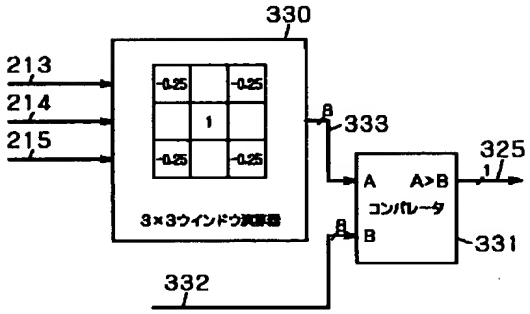
【図20】



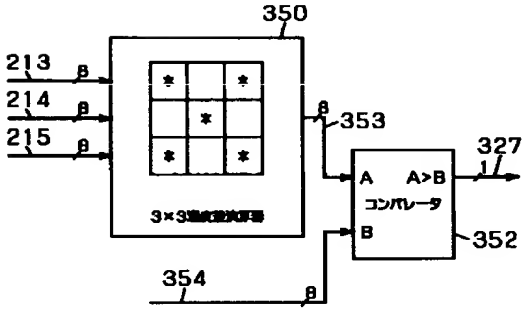
【図21】



【図22】



【図24】



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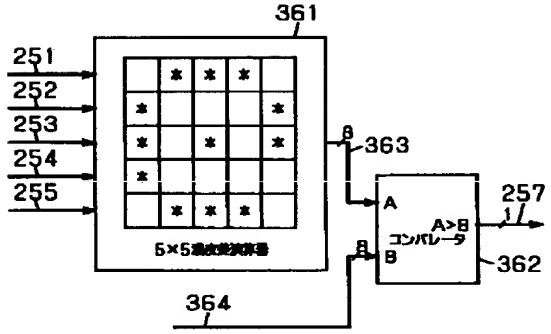
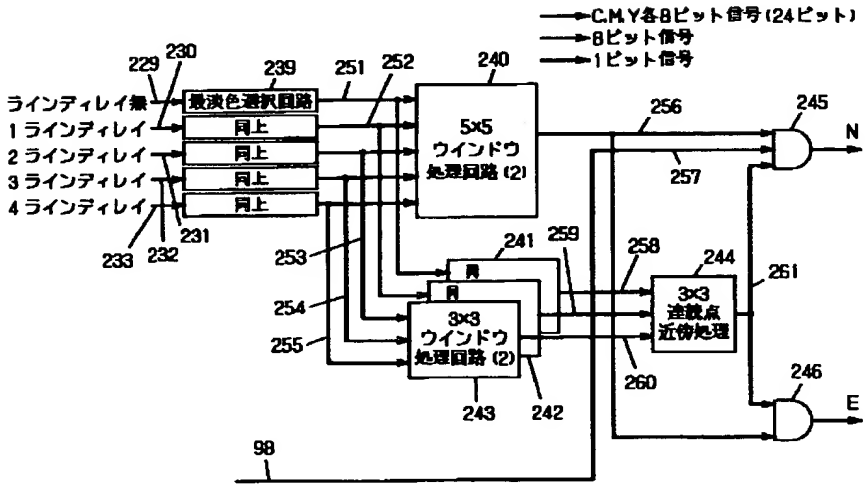


【図25】



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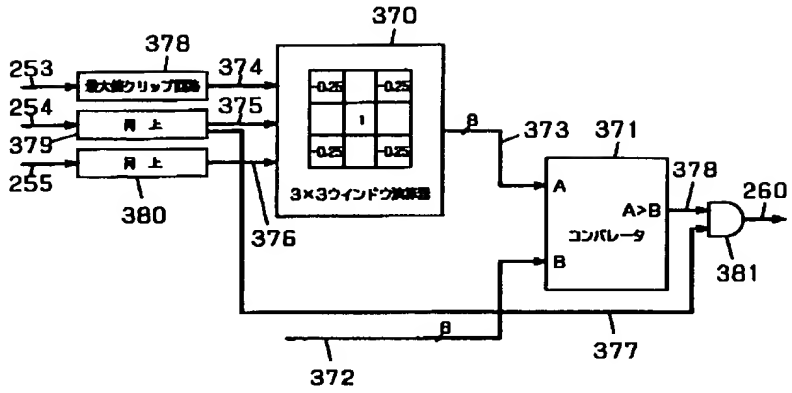

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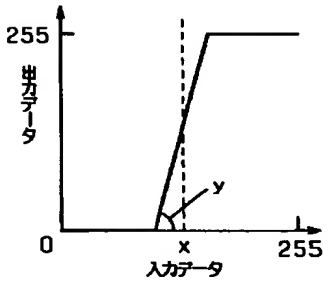

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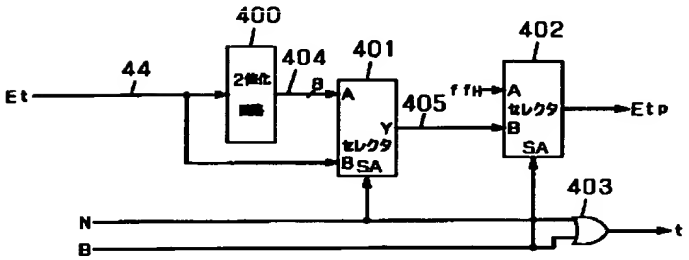

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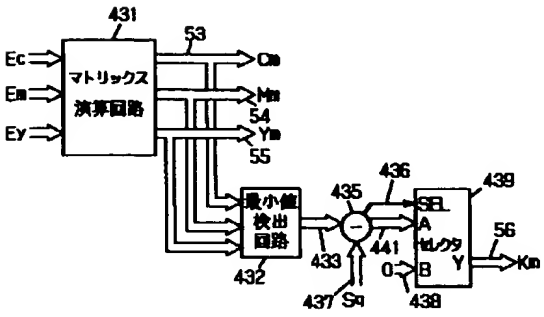

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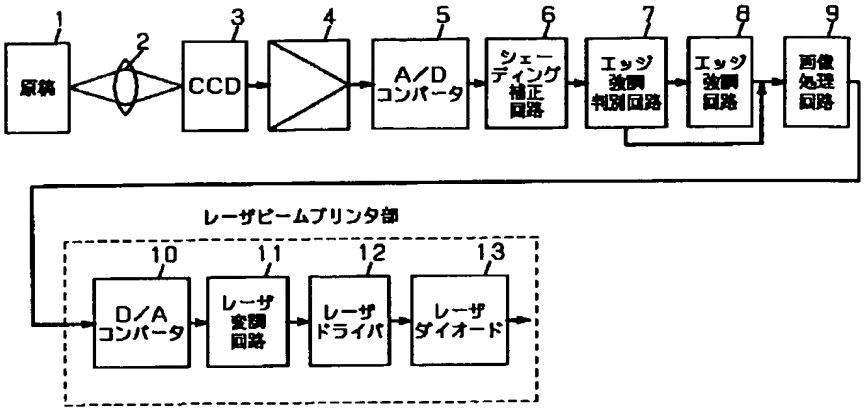
1
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5
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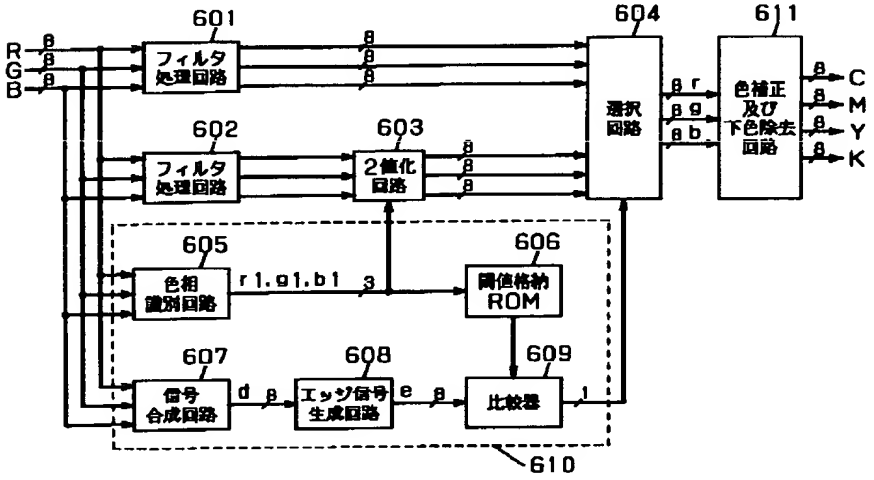
原稿
CCD
A/D コンバータ
シェーディング補正回路
エッジ強調判別回路
エッジ強調回路
画像処理回路
レーザビームプリンタ部
10
11
12
13
D/A コンバータ
レーザ変調回路
レーザドライバ
レーザダイオード

【図36】


601
602
603
604
611
R
G
B
フィルタ処理回路
フィルタ処理回路
2値化回路
選択回路
色補正及び下色除去回路
C
M
Y
K
605
606
色相識別回路
r1.g1.b1
閾値格納ROM
607
608
609
信号合成回路
エッジ信号生成回路
比較器
610

PATENT ABSTRACTS OF JAPAN

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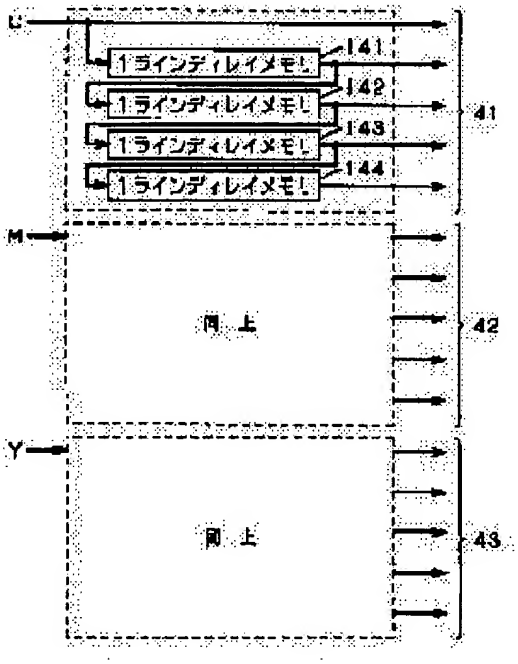
02148228	**05.06.1990**	**JP**
		JP

(54) IMAGE PROCESSOR AND DIGITAL COLOR COPYING MACHINE USING THE SAME

(57)Abstract:
PROBLEM TO BE SOLVED: To reproduce an original image with the image with high image quality by detecting a first area which is the inner area of a block character, a second area being the edge area of the black character and a third area being a color character except for the black character.
SOLUTION: A single color signal edge enhancement circuit synthesizes single color signals from the outputs 41-43 of a line memory and emphasizes edges and outputs the signal. An area identification circuit outputs the detection signal of an area which is made into maximum gray density, the detection signal of an area which is an achromatic color and the detection signal of an area where edge emphasis quantity is made larger than the other areas. An identification processing circuit processes the single color signal which is edge-enhanced in accordance with the area detection signal, outputs the signal and outputs a selection signal to selector. A masking circuit correcting the color of an edge enhanced signal and generating a black component outputs the image signal correcting the color and generating black. Thus, a black bharacter area in an original is discriminated and an original image is reproduced on a recording material only with a black material and the black character is reproduced only with the black color material.



LEGAL STATUS

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[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
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[Patent number]	3141859
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[Date of requesting appeal against examiner's decision of rejection]	07.09.2000
[Date of extinction of right]	

* NOTICES *

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] An image processing system equipped with the 1st detection means which detects the 1st field which is a contrant region of said black alphabetic character from two or more chrominance signals which carried out the readout scan and obtained a color copy containing a black alphabetic character printed black, the 2nd detection means which detects the 2nd field which is an edge field of said black alphabetic character, and the 3rd detection means which detects the 3rd field which is a field of color alphabetic characters other than said black alphabetic character.
[Claim 2] A digital color copying machine characterized by providing the following. The 1st reappearance means which reproduces the 1st image field detected with the 1st detection means of an image processing system given in the 1st term of a patent claim to a record medium by the maximum concentration only by black color material The 2nd reappearance means which reproduces the 2nd image field detected with said 2nd detection means to said record medium only by black color material The 3rd reappearance means which reproduces the 3rd image field detected with said 3rd detection means to said record medium by cyanogen, yellow, Magenta, and black color material
[Claim 3] A digital color copying machine characterized by providing the following. A monochrome signal generation means to generate a monochrome signal from two or more picture signals which carried out the readout scan and obtained a color copy An edge enhancement means to emphasize an edge component of two or more of said chrominance signals The 1st reappearance means which reproduces the 1st image field which was equipped with a binary-ized means to make said monochrome signal binary and to output a binary signal, and was detected with the 1st detection means of an image processing system given in the 1st term of a patent claim to a record medium only by black color material based on said binary signal The 3rd reappearance means which enlarges the amount of edge enhancement according the 3rd image field detected with the 2nd reappearance means which reproduces the 2nd image field detected with said 2nd detection means to a record medium only by black color material based on said binary signal, and said 3rd detection means to said edge enhancement means, and is reproduced to said record medium by cyanogen, yellow, Magenta, and black color material
[Claim 4] A digital color copying machine characterized by providing the following. A monochrome signal generation means to generate a monochrome signal from two or more picture signals which carried out the readout scan and obtained a color copy An edge enhancement means to emphasize an edge component of two or more of said

chrominance signals The 1st reappearance means which reproduces the 1st image field which was equipped with a false binary-ized means to make the contrast property of said monochrome signal steep, and to output a false binary signal, and was detected with the 1st detection means of an image processing system given in the 1st term of a patent claim to a record medium only by black color material based on said false binary signal The 3rd reappearance means which enlarges the amount of edge enhancement according the 3rd image field detected with the 2nd reappearance means which reproduces the 2nd image field detected with said 2nd detection means to a record medium only by black color material based on said false binary signal, and said 3rd detection means to said edge enhancement means, and is reproduced to said record medium by cyanogen, yellow, Magenta, and black color material

[Claim 5] A digital color copying machine which is equipped with the following and characterized by changing the contrast transfer characteristic in said false binary-ized means based on said rate of a zoom. A monochrome signal generation means to generate a monochrome signal from two or more picture signals which carried out the readout scan and obtained a color copy An edge enhancement means to emphasize an edge component of two or more of said chrominance signals A zooming means which carries out zooming of the output of said edge enhancement means at a predetermined rate of a zoom A false binary-ized means to make contrast of said monochrome signal steep and to output a false binary signal, The 1st reappearance means which reproduces the 1st image field detected with the 1st detection means of an image processing system given in the 1st term of a patent claim to a record medium only by black color material based on said false binary signal, The 2nd reappearance means which reproduces the 2nd image field detected with said 2nd detection means to a record medium only by black color material based on said false binary signal, The 3rd reappearance means which enlarges the amount of edge enhancement according the 3rd image field detected with said 3rd detection means to said edge enhancement means, and is reproduced to said record medium by cyanogen, yellow, Magenta, and black color material

[Claim 6] An image processing system given in patent claim 1 term characterized by detecting that it is said 1st image field when it has the following and an attention pixel is detected by the 1st windowing means, the near edge detection means, and achromatic color judging means. Said 1st detection means is a monochrome signal generation means to choose and output one chrominance signal for every pixel from two or more chrominance signals which carried out the readout scan and obtained a color picture. An achromatic color judging means to detect a colorless thing from said two or more chrominance signals The 1st windowing means which scans said monochrome signal in a window of a mxm pixel, and detects an edge The 2nd windowing means which scans said monochrome signal in a window of nxn smaller than m, and detects an edge, and a near edge detection means to detect that edge detection of an attention pixel and its near pixel was carried out by the 2nd windowing means

[Claim 7] An edge detection means by which said 1st windowing means detects an edge for secondary differential components in a window as compared with the 1st threshold, Said secondary differential components and a concentration detection means to detect concentration for a value adding an attention pixel as compared with the 2nd threshold, When it has at least two means among three detection means of a concentration difference detection means to detect a concentration difference for a difference of maximum of two or more pixels in a window, and the minimum

value as compared with the 3rd threshold and two or more of these detection means detect, The 1st windowing means is an image processing system given in the 6th term of a patent claim characterized by outputting a detecting signal.
[Claim 8] An edge detection means by which said 2nd windowing means detects an edge for secondary differential components in a window as compared with the 1st threshold, It has at least two means among three detection means of a concentration difference detection means to detect a concentration difference for a difference of a concentration detection means to detect concentration for an attention pixel as compared with the 2nd threshold, maximum of two or more pixels in a window, and the minimum value, as compared with the 3rd threshold. It is the image processing system given in the 6th term of a patent claim characterized by the 2nd windowing means outputting a detecting signal when two or more of these detection means detect.
[Claim 9] The 3rd term of a patent claim, the 4th term, the 5th term, and a monochrome generation means given in the 6th term are an image processing system the 3rd term of a patent claim characterized by being a means to compound a signal corresponding to one brightness or concentration from two or more chrominance signals, the 4th term, the 5th term, and given in the 6th term.
[Claim 10] An image processing system given in patent claim 1 term characterized by detecting that it is said 2nd image field when it has the following and an attention pixel is detected by the 1st windowing means, the near edge detection means, and achromatic color judging means. Said 2nd detection means is a monochrome signal generation means to generate one monochrome signal from two or more chrominance signals which carried out the readout scan and obtained a color picture. An achromatic color judging means to detect a colorless thing from said two or more chrominance signals The 1st windowing means which scans said monochrome signal in a window of a mxm pixel, and detects an edge The 2nd windowing means which scans said monochrome signal in a window of nxn smaller than m, and detects an edge, and a near edge detection means to detect that edge detection of an attention pixel and its near pixel was carried out by the 2nd windowing means
[Claim 11] The 6th term of a patent claim and an achromatic color judging means given in the 10th term are an image processing system the 6th term of a patent claim characterized by to output an achromatic color judging signal when it has an achromatic color detection means detect an achromatic color, an output of said achromatic color detection means scans in a window of kxk and all the pixels in a window are detected with an achromatic color from that of two or more chrominance signals which read, scanned and obtained a color copy, and given in the 10th term.
[Claim 12] An achromatic color detection means given in the 11th term of a patent claim is an image processing system given in the 11th term of a patent claim characterized by detecting an achromatic color when a difference of maximum and the minimum value is below a predetermined value among two or more chrominance signals which read, scanned and obtained a color copy.
[Claim 13] An image processing system given in patent claim 1 term characterized by detecting that it is said 3rd image field when it has the following and an attention pixel is detected by the 1st windowing means and near edge detection means. Said 3rd detection means is a monochrome signal generation means to compound one monochrome signal from two or more chrominance signals which carried out the readout scan and obtained a color picture. The 1st windowing means which scans said monochrome signal in a window of a mxm pixel, and detects an edge The 2nd windowing

means which scans said monochrome signal in a window of nxn smaller than m, and detects an edge A near edge detection means to detect that edge detection of an attention pixel and its near pixel was carried out by the 2nd windowing means
[Claim 14] The 10th term of a patent claim and the 1st windowing means given in the 13th term are an image processing system the 10th term of a patent claim characterized by detecting an edge for a difference of maximum of two or more pixels in a window, and the minimum value as compared with a predetermined threshold, and given in the 13th term.
[Claim 15] The 10th term of a patent claim, and the 2nd windowing means given in the 13th term A clip means to clip a picture signal in a window with the 1st threshold, An edge detection means to detect an edge for secondary differential components of a picture signal clipped with a clip means as compared with the 2nd threshold, When it has a clip pixel detection means to detect that an attention pixel is beyond the 1st threshold and said edge detection means and a clip pixel detection means detect, The 2nd windowing means is an image processing system the 10th term of a patent claim characterized by outputting a detecting signal, and given in the 13th term.
[Claim 16] The 10th term of a patent claim and a monochrome generation means given in the 13th term are an image processing system the 10th term of a patent claim characterized by being a means to choose brightest chrominance signal among two or more chrominance signals, and given in the 13th term.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention reads a color copy, performs an image processing, and relates to the image processing system used for the digital color copying machine which reproduces a manuscript image on a record medium, color facsimile, an image file system, etc.

[0002]

[Description of the Prior Art] In recent years, in the digital color copying machine, advanced features are called for and the edge enhancement processing which amends appropriately the amount of edges of the picture signal read with the image scanner, or makes [many] the amount of edge enhancement in the case of a map manuscript is also bearing a wing of advanced features.

[0003] Moreover, field discernment processing in which, as for the color copy used for a digital color copying machine etc., the black alphabetic character section and the halftone photograph section are intermingled in many cases, and the black alphabetic character section colors, reproduce it with a sharp edge [be / nothing], and reproducing the halftone section in a smooth gradation property with sufficient color reproduction nature is called for, identify a black alphabetic character field without incorrect discernment or the leakage in discernment, and suitable processing is performed is required.

[0004] The configuration and actuation are explained about an example of the conventional edge enhancement processing in a digital process copying machine, referring to a drawing below.

[0005] The block diagram of signal processing of the digital process copying machine of the former [drawing 1] and drawing 2 show the operation method of the conventional edge enhancement circuit.

[0006] In drawing 1 , 1 shows the manuscript used as an input and it is CCD whose 2 is a lens and whose 3 is image sensors. 4 is amplifier which amplifies the output from CCD3, and 5 is an A/D converter which changes the analog quantity into digital one. 6 is a shading compensation circuit and 7 is an edge enhancement distinction circuit. This edge enhancement distinction circuit 7 passes an input signal to the next edge enhancement circuit 8, when distinguishing whether edge enhancement is carried out to an input image and emphasizing the edge section, and delivery and when not carrying out edge enhancement, it passes an input signal to the image-processing circuit 9. In addition, when this distinction has the absolute value of the difference of the concentration of an attention pixel, and the concentration of two or more circumference pixels which are in a predetermined range from an

attention pixel larger than a predetermined value, edge enhancement is performed, and edge enhancement is not performed when small. In the image-processing circuit 9, the edge enhancement circuit 8 carries out output signal processing, for example, it is gamma correction processing. 10 is a D/A converter which changes the digital signal from the image-processing circuit 9 into an analog signal. 11 is a laser modulation circuit which outputs a Pulse-Density-Modulation signal based on the analog signal from D/A converter 10. 12 is a laser driver which drives a laser diode 13.

[0007] D/A converter 10, the laser modulation circuit 11, a laser driver 12, and a laser diode 13 are the components of a well-known laser beam printer, and reproduce a manuscript image by the laser beam printer.

[0008] Drawing 2 shows the operation method of an edge enhancement circuit, and the center of the pixel window of 3x3 is an attention pixel. 4 pixels of a vertical angle are a circumference pixel, and subtracting the sum of the concentration of 4 pixels of circumferences from the value which multiplied the concentration which is an attention pixel by 5 is shown. That is, secondary differential is subtracted to the concentration of an attention pixel, and edge enhancement is performed (for example, JP,62-183672,A).

[0009] The configuration and actuation are explained about an example of the conventional field discernment processing used for a digital color copying machine, referring to a drawing below.

[0010] Drawing 3 is the block diagram of the conventional field discernment processing circuit in a digital color copying machine.

[0011] In drawing 3 , R, G, and B are the chrominance signals which scanned and read the manuscript. Chrominance signals R, G, and B are inputted into the filtering circuit 601 for halftone images, the filtering circuit 602 for binary images, and the field discrimination decision circuit 610 in juxtaposition. The filtering circuit 601 for halftone images is a two-dimensional filter which assumes that an attention pixel field is a halftone image field, and performs band emphasis processing. The frequency characteristic of this filter is set up so that a halftone dot component may be removed and the sharpness of an image may be raised. The filtering circuit 602 for binary images assumes that an attention pixel field is a binary image field, and performs emphasis processing of edge components, such as an alphabetic character. The binary-ized circuit 603 makes chrominance signals R, G, and B binary with each threshold, only when the hue signals rl, gl, and bl from the hue discrimination circuit 605 mentioned later are ON, and when rl, gl, and bl are OFF, it outputs chrominance signals R, G, and B as they are.

[0012] With the judgment signal from the field discrimination decision circuit 610 which describes below the filtering circuit 601 for halftone images obtained as mentioned above, and the data for binary images from the binary-ized circuit 603, it switches by the selection circuitry 604 and outputs to a next processing circuit.

[0013] The field discrimination decision circuit 610 is constituted by the threshold storing ROM 606 which stores the threshold the hue discrimination circuit 605 and for a field judging, the signal composition circuit 607, the edge signal generating circuit 608, and the comparator 609. From chrominance signals R, G, and B, a signal composition circuit is changed into brightness and generates a composite signal d.

[0014] The edge signal generation circuit 608 considers a composite signal d as an

input, calculates the difference of the maximum in the pixel window of 3x3 centering on an attention pixel, and the minimum value, and outputs it as an edge signal e. In a comparator 609, if smaller as a binary image field than 1 and a threshold with [as compared with a certain specific threshold] a threshold [beyond] for the edge signal e, 0 will be outputted to a selection circuitry 604 as a halftone image field. The hue discrimination circuit 605 identifies the hue of an attention pixel to yellow, a Magenta, cyanogen, black, red, green, and seven blue hues, and outputs the hue signals rl, gl, and bl. The threshold storing ROM makes an address signal the hue signals rl, gl, and bl, and the judgment threshold for the field discernment according to a hue outputs it to a comparator 609 as a 8-bit signal. A comparator 609 compares the edge signal e from the threshold for every hue, and the edge signal generation circuit 608, identifies a halftone field or an alphabetic character field, chooses the signal which performed processing which was suitable for each field from that of a selection circuitry 604, and outputs it to color correction and the lower color removal circuit 611 as signals r, g, and b. In color correction and the lower color removal circuit 611, while amending muddiness of a color, lower color removal processing is performed and cyanogen (C), a Magenta (M), yellow (Y), and a black (K) signal are generated. The color printer which is not illustrated reproduces a manuscript image to a record medium by the color material corresponding to each color (for example, JP,64-41377,A).

[0015]

[Problem(s) to be Solved by the Invention] When it is going to identify a little small alphabetic character field of an edge component, a little large field of the edge component of the halftone section is carried out an alphabetic character field and misjudgment exception, and it becomes impossible however, to reproduce a halftone field smoothly with the configuration of the above field discernment processings. Moreover, if it is going to lose this misjudgment exception, it becomes impossible to identify only the alphabetic character field where an edge component is sufficiently big, and the repeatability of the alphabetic character section will worsen.

[0016] Furthermore, about the alphabetic character section, especially the black alphabetic character section important at the time of playback of an alphabetic character photograph mixture manuscript, repeatability becomes good on a property with a color printer more common to reproduce a black alphabetic character only by black color material. Although a color printer reproduces a color picture by piling up cyanogen, yellow, a Magenta, and the color material of black on record material, when reproducing black for the color material of cyanogen, yellow, and a Magenta in piles, it is difficult to obtain whenever [sufficient achromatic color], and concentration, and is because coloring may arise in the edge section of a black alphabetic character by the location gap at the time of a color pile.

[0017] It aims at offering the image processing system and digital color copying machine which reproduce a manuscript image by the high-definition image by reducing the incorrect discernment which this invention reproduces a black alphabetic character only by black color material, and raises the image quality of a black alphabetic character in view of the above-mentioned technical problem, and is identified as the alphabetic character section of fields other than the black alphabetic character section of a manuscript image.

[0018]

[Means for Solving the Problem] The 1st detection means which detects the 1st field which is a contrant region of said black alphabetic character from two or more chrominance signals which this invention carried out the readout scan of the color copy containing a black alphabetic character printed black, and were acquired in order to attain the above-mentioned purpose, It is characterized by having the 2nd detection means which detects the 2nd field which is an edge field of said black alphabetic character, and the 3rd detection means which detects the 3rd field which is a field of color alphabetic characters other than said black alphabetic character.

[0019]

[Embodiment of the Invention] Drawing 4 is the block diagram of signal processing of the digital color copying machine in the gestalt of operation of this invention.

[0020] In drawing 4 , 21 is the color image sensors of the Rhine mold which scans a manuscript and reads the image information of a manuscript. 22 is the amplifier which amplifies the red whose color was separated from image sensors 21, green, and the picture signals R, G, and B which correspond blue, and outputs amplified picture signal R', G', and B'. 23 is an A/D converter which changes into digital one picture signal R' which is an analog quantity, G', and B'. 24 is a shading compensation circuit which amends the shading distortion at the time of image reading of image sensors 21. a shading compensation -- a circuit -- 24 -- an A/D converter -- an output -- Rd -- Gd -- Bd -- an input -- ** -- carrying out -- a shading compensation -- processing -- having carried out -- a picture signal -- R -- ″ -- G -- ″ -- B -- ″ -- outputting . 25 is a concentration conversion circuit and changes G-″ B ″ into the picture signals C, M, and Y of a density scale R ″ of picture signals of a reflection factor scale. Picture signals C, M, and Y are equivalent to the chrominance signal of cyanogen, yellow, and a Magenta. 26 is the Rhine memory circuit and is an object for the Rhine delay for performing 5x5-pixel windowing in the edge enhancement circuit 27, the monochrome signal edge enhancement circuit 57, and the field discrimination decision circuit 28. The Rhine memory circuit 26 outputs the signals 41, 42, and 43 for every color which does not have the signal delayed one line in the concentration picture signals C, M, and Y, respectively, the signal delayed two lines, the signal delayed three lines, the signal, and delay which were delayed four lines. The edge enhancement circuit 27 outputs the signals Ec, Em, and Ey which considered the outputs 41, 42, and 43 of the Rhine memory as the input, and carried out edge enhancement of the attention pixel signal, respectively.

[0021] The monochrome signal edge enhancement circuit 57 compounds and carries out edge enhancement of the monochrome signal from the outputs 41, 42, and 43 of the Rhine memory, and outputs a signal Et44.

[0022] The field discrimination decision circuit 28 outputs the detecting signal E of the field which makes larger than other fields the detecting signal B, the detecting signal N of the field which should be colorless, and the amount of edge enhancement of the field which should be made the maximum gray concentration. If a detecting signal E is inputted into the edge enhancement circuit 27 and the monochrome signal edge enhancement circuit 57 and a detecting signal is set to HI, the amount of edge enhancement will become large.

[0023] 58 is a discernment processing circuit and outputs the signal Etp59 which processed the monochrome signal Et44 by which edge enhancement was carried out

according to the field detecting signals B and N. Moreover, the discernment processing circuit 58 outputs a select signal t49 to a selector 30.
[0024] 29 is the picture signal 53 which is the masking circuit which generates color correction and black component of the edge enhancement signals Ec, Em, and Ey, and performed color correction and black generation. Cm, 54 Mm, 55 Ym, 56 Km is outputted.
[0025] 30 is a selector which outputs the picture signals Cm, Mm, Ym, and Km which the masking circuit 29 outputs, and the picture signal S which chose one from from among signal 59Etp(s) which the discernment processing circuit 58 outputs, and was chosen.
[0026] 50 is a zoom circuit and performs zooming processing of the Rhine scanning direction (main scanning direction). A zoom circuit realizes the zoom function of the Rhine scanning direction by performing interpolation processing and infanticide processing of a picture signal. Zooming processing of the direction of vertical scanning is realized by changing the vertical-scanning speed of an image reader. For example, if vertical-scanning speed is set to one half, it will become the rate of a zoom of 200% of the direction of vertical scanning.
[0027] 31 is a gamma correction circuit, amends the gradation property of the below-mentioned laser beam printer, and outputs the picture signal Sg by which the gamma correction was carried out. The gamma correction circuit 31 is realized by performing D / D conversion by the look-up table which used memory. 32 is a D/A converter which changes into an analog quantity the picture signal Sg which is a digital signal. 33 is a Pulse-Density-Modulation circuit which carries out Pulse Density Modulation with the magnitude of the analog quantity outputted from D/A converter 32. 34 is a laser driver which drives a laser diode 35 with the picture signal by which Pulse Density Modulation was carried out. 31, 32, 33, 34, and 35 constitute a well-known laser beam printer.
[0028] The manuscript image read with image sensors 21 is reproduced by the laser beam printer. a laser beam printer -- a color plane -- cyanogen, yellow, a Magenta, and the color pile of black are performed by sequential, and a color picture is reproduced.
[0029] Image sensors 21 scan a manuscript image 4 times, and a selector 30 chooses the picture signal corresponding to the color reproduced by the laser beam printer. However, a selector 30 will set Signal S to 0, if a select signal t49 is set to HI while choosing Cm, Mm, or Ym. Moreover, while choosing Km, a selector 30 will choose and output a signal 59, if a select signal t49 is set to HI.
[0030] Thus, it can abolish that can reproduce a black alphabetic character by whenever [sufficient achromatic color], and concentration, and coloring arises in the edge section of a black alphabetic character by the location gap at the time of the color pile of a color printer by distinguishing the black alphabetic character field in a manuscript, reproducing a manuscript image on record material only by black color material, and reproducing a black alphabetic character only by black color material.
[0031] The concentration conversion circuit 25 in drawing 4 is explained. Drawing 5 is some block diagrams of a concentration conversion circuit. The concentration conversion circuit 25 is realized by the technique of the look-up table which used memory. In drawing 5 , 131 is memory, 132 is R″ of picture signals of the reflection factor scale of drawing 4 , G″, or B″, and it is inputted into the addresses A7-A0 of memory 131. 133 is data read from memory and corresponds to the

picture signals C, M, and Y of the density scale of drawing 4 . The concentration conversion circuit 25 has G ″ of three memory to B ″ R ″ of input signals in fact. 134 is a selection signal which chooses one of eight sorts of look-up tables which are inputted into the addresses A10-A8 of memory 131, and are memorized by memory 131. The control section which controls a copying machine and which is not illustrated sets up a selection signal.

[0032] Drawing 6 is the graph of the example of the data of the look-up table memorized by the memory 131 in drawing 4 . It is obtained when changing into concentration from a reflection factor calculates the logarithm of a reflection factor. By changing the configuration of the curve of the look-up table in drawing 6 , the contrast of a playback image, the dynamic range of concentration, etc. are changeable. In the case of drawing 2 , eight sorts of different look-up tables are memorized by memory 131, and can choose.

[0033] Drawing 7 is the block diagram of the Rhine memory circuit 26 in drawing 4 . 141, 142, 143 and 144 are one-line delay memory delayed one line in the inputted picture signal. The Rhine memory circuit 26 of drawing 4 outputs the signals 41, 42, and 43 without the signal delayed one line in the concentration picture signals C, M, and Y, respectively, the signal delayed two lines, the signal delayed three lines, the signal, and delay which were delayed four lines.

[0034] Drawing 8 is the block diagram of the edge enhancement circuit 27 in drawing 4 . 101 is the amount detector of edges, scans a picture signal in the 5x5-pixel window which considers five signals 41 with which the numbers of delay lines differ as an input, and makes an attention pixel a main pixel, and outputs the amount signal 104 of edges of an attention pixel. 102 is the amount conversion circuit of edges. The amount conversion circuit 102 of edges outputs the amount signal 105 of edges which changed the amount signal 104 of edges and was changed in the magnitude of an edge signal according to the magnitude of the amount of edges.

[0035] 103 is the amount adder circuit of edges. The amount adder circuit 103 of edges adds the value which multiplied the concentration signal 108 of an attention pixel, and the changed amount signal 105 of edges by the coefficient from which plurality differs, and outputs the saturation state signal 127 which whether the added value is over the dynamic range of a signal shows. Moreover, one of said the added values is chosen with the amount selection signal 122 of edge enhancement from the amount control circuit 130 of edges, and the signal Ec by which edge enhancement was carried out is outputted. There is a portion which consists of the amount detector 101 of edges, an amount conversion circuit 102 of edges, and an amount adder circuit 103 of edges for every chrominance signal, and it outputs the edge enhancement signals Ec, Em, and Ey which increased the edge component of the concentration signal of each color.

[0036] The amount control circuit 130 of edges considers the saturation state signal 127, 128, 129 outputted from the amount adder circuit of edges for every chrominance signal, and the detecting signal E from the field discrimination decision circuit 28 as an input, and outputs the amount selection signal 122 of edge enhancement.

[0037] The amount detector 101 of edges in drawing 8 is explained using drawing 9 . Drawing 9 is explanatory drawing of the amount detector 101 of edges of operation.

[0038] A picture signal is scanned in the 5x5-pixel window which considers five signals 41 with which the numbers of delay lines differ as an input, and makes an attention pixel a main pixel. The amount signal 104 of edges which calculated the

amount of edges of the attention pixel of the center of a window by the operation (concentration x2of attention pixel)- (concentration x0.5 of the pixel of four corners of a window) is outputted.
[0039] Next, the amount conversion circuit 102 of edges in drawing 8 is explained using drawing 10 , drawing 11 , and drawing 12 .
[0040] Drawing 10 is drawing showing the 1st example of the transfer characteristic of the amount conversion circuit of edges. When the magnitude of the amount signal of edges inputted into the amount conversion circuit of edges is smaller than a, the amount conversion circuit of edges outputs 0. When the magnitude of the amount signal of edges inputted is larger than b, the value which multiplied the input signal by the coefficient k is outputted. The value to which the input signal was multiplied by the coefficient i at the time of a to b, and the magnitude of the amount signal of edges inputted added the constant c is outputted. It is made for a coefficient i and a constant c to become the amount transfer characteristic of edges when the magnitude of the amount signal of input edges is smaller than a, and when larger than b, and continuation at this time.
[0041] Drawing 11 is ****** which shows the 2nd example of the transfer characteristic of the amount conversion circuit of edges. When the magnitude of the amount signal of edges inputted into the amount conversion circuit of edges is smaller than a, the amount conversion circuit of edges outputs 0. When the magnitude of the amount signal of edges inputted is larger than b, the value which multiplied the input signal by the coefficient k is outputted. The value expressed with the curve as the magnitude of the amount signal of edges inputted indicates it in drawing 11 at the time of a to b is outputted. It is made to become the amount transfer characteristic of edges when the magnitude of the amount signal of edges inputted is smaller than a, and when larger than b, and continuation at this time.
[0042] Drawing 12 is the block diagram of the amount conversion circuit 102 of edges in drawing 8 which realizes the transfer characteristic shown in drawing 10 and drawing 11 . 71 is an absolute-value circuit which considers the amount signal 104 of edges as an input, and outputs the absolute value 75 and sign bit 79 of the amount signal of edges. 72 is memory and the absolute value 75 of the amount signal of edges is inputted into the addresses ADR8-ADR0 of memory 72. The look-up table data for conversion is memorized by memory 72. Two or more look-up tables which changed a, b, and k which were shown in drawing 10 or drawing 11 are memorized by memory 72, and one look-up table is chosen as it among those by the look-up table selection signal 78. The look-up table selection signal 78 is inputted into the addresses ADR11-ADR9 of memory 72, and chooses one of eight sorts of look-up tables memorized by memory. The control section which controls a copying machine and which is not illustrated sets up a look-up table selection signal. 61 is an exclusive OR gate and considers a sign bit 79 and a control signal INV as an input. The control section of the copying machine which is not illustrated outputs a control signal INV. If INV is set to HI, in order that a sign bit 79 may be reversed, and may be outputted and the sign of the edge component of a picture signal may be reversed as a result, processing which obscures a picture signal will be realized in an edge enhancement circuit. 73 is a two's complement conversion circuit and outputs the changed amount signal 105 of edges which was expressed with the two's complement from the positive value 76 and positive sign bit changed by the look-up table.
[0043] It can carry out adjustable [of the amount of oppression of impudence of the noise component in the picture signal by edge enhancement processing] by

preparing two or more look-up tables from which the value of a in drawing 10 and drawing 11 differed. By preparing two or more look-up tables which are different in the value of a coefficient k, it can carry out adjustable [of the amount of edge enhancement]. Furthermore, a continuity is changeable into the amount of edge enhancement by preparing two or more look-up tables which are different in the value of b. When memory 72 is constituted from memory which can memorize at least one look-up table for the amount conversion of edges and which can be written in and the transfer characteristic is changed in drawing 12 , the control section which controls a copying machine and which is not illustrated may also write in look-up table data. Moreover, as shown in drawing 10 , when the transfer characteristic is the polygonal line, the transfer characteristic of drawing 10 may be realized using not the look-up table that used memory but a multiplier, an adder, etc.

[0044] Before explaining the amount adder circuit 103 of edges, the phenomenon which a color thin line and a color edge achromatic-color-ize by edge enhancement processing is explained.

[0045] Drawing 13 is a graph which shows 8 bits [into which the color was separated when reading the blue thin line on a white ground with an image scanner] R, G, and B concentration data. In a location d, since the concentration of B is large compared with R and G, the color in a location d is blue.

[0046] Drawing 14 is data after carrying out edge enhancement processing to the concentration data shown in drawing 13 . In location d', in order to exceed the dynamic range of a concentration signal by edge enhancement processing, both R, G, and B data will be set to 255, and will become black. Thus, when the picture signal after edge enhancement exceeds the dynamic range of a signal by edge enhancement processing, a chrominance signal achromatic-color-izes.

[0047] Next, the amount adder circuit 103 of edges and the amount control circuit 130 of edges which were shown in drawing 8 are explained using drawing 15 .

[0048] Drawing 15 is a block diagram of the amount adder circuit 103 of edges, and the amount control circuit 130 of edges.

[0049] 103 is the amount adder circuit of edges. The amount signal of edges from which 105 was changed, and 108 are the picture signals of an attention pixel. As for 2 double computing element which outputs the signal 105 twice the value of the amount of edges from which 81 was changed, and 82, 1 / 2 double computing element, and 83 are 1/twice computing elements. Each computing element is realizable by the bit shift. 84 outputs by setting the saturation state signal 123 to HI, when the value which is an adder and added the output and attention picture signal of the 2 double computing element 101 exceeds the dynamic range of 0-255 which can be expressed by 8 bits. Adders 85, 86, and 87 output the saturation state signals 124, 125 and 126 similarly, respectively. Based on the amount selection signal 122 of edge enhancement, a selector 108 considers the outputs 84, 85, 86, and 87 and the attention pixel signal 108 of each adder as i4, i3, i2, i1, and i0 input, respectively, chooses one of inputs and outputs the picture signal Ec by which edge enhancement was carried out. The amount selection circuitry of edge enhancement which consists of a computing-element group, an adder group, and a selector outputs those with three, and the signals Ec, Em, and Ey by which edge enhancement was carried out, respectively for every chrominance signal. The saturation state signal 127 of drawing 8 shows the saturation state signals 123, 124, 125 and 126 of drawing 15 collectively.

[0050] 130 is the amount control circuit of edges. 109,110,111 and 112 are OR gates, consider the saturation state signal signal for every color as an input, and output signals 118,119,120 and 121. 113 is a priority encoder and considers the output 118,119,120,121 of an OR gate as I1, I2, I3, and I4 input, respectively. Furthermore, the detecting signal E of the field which should make the amount of edge enhancement larger than other fields is considered as an input, and outputs the amount selection signal 122 of edge enhancement. the case where E is HI -- a priority encoder 113 -- the inside of Input In (n is 1-4) -- largest n -- and when In is LOW, the amount selection signal 122 of edges is outputted so that a selector 108 may choose Input in (n is 1-4). the case where E is LOW -- a priority encoder 113 -- the inside of Input In (n is 1-3) -- largest n -- and when In is LOW, a selector 108 outputs the amount selection signal 122 of edges which chooses Input in (n is 1-3). When the input In of a priority encoder is HI altogether, it is not concerned with E but a priority encoder 113 outputs 122 for the amount selection signal of edges with which a selector 108 chooses an input i0.
[0051] Drawing of the selection signal which a selector 108 chooses as drawing 16 with the input of a priority encoder 113 is shown.
[0052] When the signal after edge enhancement oppresses the amount of edge enhancement as mentioned above so that the dynamic range of a picture signal may not be exceeded, achromatic color-ization of a color thin line or a color edge can be prevented. Although it is better to make [many] the amount of edge enhancement and to copy it especially in the case of a map manuscript with many color thin lines etc., it can prevent that a color thin line is reproduced as linea nigra at this time.
[0053] Drawing 17 is the block diagram of the monochrome signal edge enhancement circuit 57 in drawing 4 . 271,272,273,274 and 275 are chrominance-signal composition circuits, consider C and M from which the number of the Rhine delay differs, respectively, and a Y signal (41, 42, 43) as an input, and output one compounded monochrome signal. For example, it computes by a-C+b-M+c-Y (a, b, and c are a predetermined coefficient). The amount detector 276 of edges is the same as the amount detector 101 of edges of drawing 8 , scans said monochrome signal in the window of 5x5, and outputs the amount signal 277 of edges. The amount conversion circuit 278 of edges is the same as that of the amount conversion circuit 102 of edges of drawing 8 , and the signal 279 which changed the amount signal 277 of edges is outputted. The amount conversion circuit 280 of edges adds the amount signal 279 of edges changed when E was LOW, and the monochrome signal 281 of an attention pixel, when E is HI, adds the changed monochrome signal 281 of the twice and the attention pixel of the amount signal 279 of edges, and outputs the monochrome signal Et44 which carried out edge enhancement.
[0054] Drawing 18 is the block diagram of the field discrimination decision circuit 28 in drawing 4 . 91 is the maximum gray concentration field detector, considers as an input the signals 41, 42, and 43 with which the numbers of delay lines for every color differ, and outputs the maximum gray concentration field detecting signal B and the achromatic color judging signal 98. 92 is an achromatic-locus discrimination decision circuit and an edge enhancement increase field detector, considers as an input the signals 41, 42, and 43 and the achromatic color judging signal 98 with which the numbers of delay lines for every color differ, and outputs the achromatic-locus detecting signal N and the edge enhancement increase field detecting signal E.

[0055] Drawing 19 is the block diagram of the maximum gray concentration field detector 91 in drawing 18 . 229 and 230,231,232,233 are C and M from which the number of delay lines differs, respectively, and Y concentration signal. 201 is a monochrome-ized circuit, considers C, M, and Y concentration signal as an input, and compounds and outputs the monochrome signal 211 corresponding to one concentration. A monochrome-ized circuit outputs those with five, and the monochrome signals 211 and 212,213,214,215 with which the numbers of delay lines differ, respectively for every signal of the different number of delay lines.
[0056] 202 is the 5x5 windowing circuit 1, scans said monochrome signal by 5x5 pixels, and outputs the signal 216 carried out 5x5 windowing 1.
[0057] 203,204,205 is the 3x3 windowing circuit 1, scans said monochrome signal by 3x3 pixels, and outputs the 1-bit signal 217,218,219 carried out 3x3 windowing 1, respectively. 3x3 windowing circuit 1 203 considers a monochrome signal 211,212,213 as an input, and is the 3x3 windowing circuit 1. 204 considers a monochrome signal 212,213,214 as an input, and is the 3x3 windowing circuit 1. 205 considers a monochrome signal 213,214,215 as an input, and outputs the signal 217,218,219 with which the numbers of delay lines differ and which was carried out 3x3 windowing 1, respectively. It is a processing-near point continuing [3x3] circuit, 206 scans the signal 217,218,219 with which the numbers of delay lines differ and which carried out 3x3 windowing in a 3x3-pixel window, and when there is a following-9 pixels [2] or more of 3x3-pixel window pixel, it sets to HI the 1-bit signal 220 by which processing near the point continuing [3x3] was carried out.
[0058] It is an achromatic color detector, 208 considers C and M which were delayed one line, and Y concentration signal 232 as an input, and when the difference of the largest value and the smallest value is below a predetermined value among C, M, and Y, it sets the achromatic color detecting signal 221 to HI. The signal which performed achromatic color detection from C and M which the signal which performed achromatic color detection is the achromatic color detecting signal 222, and were delayed for C and M which were delayed two lines, and Y concentration signal 232 three lines, and Y concentration signal 232 is the achromatic color detecting signal 223.
[0059] The achromatic color detecting signal 221,222,223 from which the number of delay lines differed is considered as an input, it is about 3x3 processing circuit, 209 scans an achromatic color detecting signal in a 3x3-pixel window, and when [in a 3x3 pixel window] 9 pixels of all achromatic color judging signals are HI, it sets the achromatic color judging signal 98 to HI.
[0060] 207 is an AND gate, calculates the OR of the signal 216 carried out 5x5 windowing 1, the signal 220 by which processing near the point continuing [3x3] was carried out, and the achromatic color judging signal 98, and outputs the maximum gray concentration field B.
[0061] Drawing 20 is the block diagram of 202 of the 5x5 windowing circuit 1 in drawing 19 .
[0062] 570 is a 5x5 edge detector, it considers as an input the monochrome signals 211 and 212,213,214,215 with which the numbers of delay lines differ, scans said monochrome signal in a 5x5-pixel window, and outputs the 5x5 edge detecting signal 577 and the 5x5 edge component signal 575. The center of a 5x5-pixel window is an attention pixel here.
[0063] 571 is a 5x5 concentration detector, considers a 5x5 edge component signal and a monochrome signal 213 as an input, and outputs the concentration detecting

signal 576 of an attention pixel.
[0064] 572 is a 5x5 concentration difference detector, it considers as an input the monochrome signals 211 and 212, 213, 214, 215 with which the numbers of delay lines differ, scans said monochrome signal in a 5x5-pixel window, and outputs the 5x5 concentration difference detecting signal 578 in a pixel window.
[0065] 574 is an AND gate, calculates the OR of the 5x5 edge detecting signal 577, the 5x5 concentration detecting signal 576, and the 5x5 concentration ****** signal 578, and outputs the signal 216 carried out 5x5 windowing 1.
[0066] Drawing 21 is the block diagram of the 5x5 edge detector 570 in drawing 20 . 580 is a 5x5 window computing element, considers as an input the monochrome signals 211 and 212, 213, 214, 215 with which the numbers of delay lines differ, and scans said monochrome signal in a 5x5-pixel window. The 5x5 edge component signal 575 is outputted by adding the sum of the value which carried out the value of the pixel of four corners 1/4 from the pixel data of the center of said window of 5x5. It is a comparator, 581 compares said 5x5 edge signal 575 with the predetermined threshold 582 which the control section of the copying machine which is not illustrated sets up, and when the 5x5 edge component 575 is larger than said predetermined threshold 582, it outputs the 5x5 edge detection 575 used as HI.
[0067] Drawing 22 is the block diagram of the 5x5 concentration detector 571 in drawing 20 . 291 is an adder, adds the 5x5 edge component signal 575 and the monochrome signal 213 of an attention pixel, and outputs the edge component addition signal 294. 292 is a comparator, compares said edge component addition signal 294 with the predetermined threshold 293 which the control section of the copying machine which is not illustrated sets up, and when the edge component addition signal 294 is larger than said predetermined threshold 293, it outputs the 5x5 edge detection 576 used as HI.
[0068] Drawing 23 is the block diagram of the 5x5 concentration difference detector 572 in drawing 20 . 301 is a 5x5 concentration difference computing element, it considers as an input the monochrome signals 211 and 212, 213, 214, 215 with which the numbers of delay lines differ, scans said monochrome signal in a 5x5-pixel window, calculates the difference of the maximum of a pixel, and the minimum value which carried out the mark shown in drawing in the window of 5x5, and outputs the 5x5 concentration difference signal 305. An attention pixel is a pixel of the center of the window of 5x5 here. It is a comparator, 302 compares with the monochrome concentration difference signal 305 of an attention pixel the predetermined threshold 310 which the control section of the copying machine which is not illustrated sets up, and when the concentration difference signal 305 of an attention pixel is larger than the predetermined value 310, it outputs the signal 578 set to HI.
[0069] Drawing 24 is the 3x3 windowing circuit 1 in drawing 19 . It is the block diagram of 205.
[0070] 320 is a 3x3 edge detector, it considers the monochrome signal 213, 214, 215 with which the numbers of delay lines differ as an input, scans said monochrome signal in a 3x3-pixel window, and outputs the 3x3 edge detecting signal 325. The center of a 3x3-pixel window is an attention pixel here.
[0071] 321 is a concentration detector, considers a monochrome signal 213 as an input, and outputs the concentration detecting signal 326 of an attention pixel.
[0072] 323 is a 3x3 concentration difference detecting signal, it considers the monochrome signal 213, 214, 215 with which the numbers of delay lines differ as an

input, scans said monochrome signal in a 3x3-pixel window, and outputs the 3x3 concentration difference detecting signal 327 in a pixel window.
[0073] 324 is an AND gate, calculates the OR of the 3x3 edge detecting signal 325, the concentration detecting signal 326, and the 3x3 concentration difference detecting signal 327, and outputs the signal 219 carried out 3x3 windowing 1.
[0074] Drawing 25 is the block diagram of the 3x3 edge detector 320 in drawing 24 . 330 is a 3x3 window computing element, considers the monochrome signal 213,214,215 with which the numbers of delay lines differ as an input, and scans said monochrome signal in a 3x3-pixel window. By adding the sum of the value which carried out the pixel of four corners of a window 1/4 from the attention pixel of said 3x3 windows, the 3x3 edge component signal 333 is outputted. It is a comparator, 331 compares said 3x3 edge component signal 333 with the predetermined threshold 332 which the control section of the copying machine which is not illustrated sets up, and when the 3x3 edge component signal 333 is larger than said predetermined threshold, it outputs the 3x3 edge detecting signal 325 set to HI.
[0075] Drawing 26 is the block diagram of the concentration detector 321 in drawing 24 . It is a comparator, 340 compares the monochrome signal 214 of an attention pixel with the predetermined threshold 341 which the control section of the copying machine which is not illustrated sets up, and when the monochrome signal 214 of an attention pixel is smaller than a predetermined threshold, it outputs the concentration detecting signal 326 used as HI.
[0076] Drawing 27 is the block diagram of the 3x3 concentration difference detector in drawing 24 . 350 is a 3x3 concentration difference computing element, considers the monochrome signal 213,214,215 with which the numbers of delay lines differ as an input, and scans said monochrome signal in a 3x3-pixel window. The difference of the maximum of a pixel and the minimum value which carried out the mark in drawing of said 3x3 windows is calculated, and the 3x3 concentration difference signal 353 is outputted. It is a comparator, 352 compares said 3x3 concentration difference signal 353 with the predetermined threshold 354 which the control section of the copying machine which is not illustrated sets up, and when the 3x3 concentration difference signal 353 is larger than said predetermined threshold, it outputs the 3x3 concentration difference detecting signal 327 set to HI.
[0077] The maximum gray concentration field detector 91 of drawing 18 is realized with the above configurations, and from that of setting up a social status location the optimal, since the field which should be made the maximum gray concentration is detected from the information on the continuity of the concentration after the edge enhancement of an attention pixel, the edge component in a 5x5-pixel window, and the edge in a 3x3-pixel window, and the achromatic color pixel near the attention pixel, incorrect detection can be lessened extremely.
[0078] Next, the achromatic-locus detector of drawing 18 and the edge enhancement increase field detector 92 are explained.
[0079] Drawing 28 is the block diagram of the achromatic-locus detector in drawing 18 , and the edge enhancement increase field detector 92. 229 and 230,231,232,233 are C and M from which the number of delay lines differs, respectively, and Y concentration signal. 239 is the maximum light color selection circuitry, it considers C, M, and Y concentration signal as an input, chooses the signal of the largest value, and outputs the one maximum light color signal 251. The maximum light color selection circuitry outputs those with five, and the maximum light color signals 251 and 252,253,254,255 with which the numbers of delay lines differ,

respectively for every signal of the different number of delay lines.
[0080] 240 is the 5x5 windowing circuit 2. It is 240, and said maximum light color signal is scanned by 5x5 pixels, and the signal 256 carried out 5x5 windowing 2 is outputted.
[0081] 241, 242, 243 is the 3x3 windowing circuit 2, scans said maximum light color signal by 3x3 pixels, and outputs the 1-bit signal 258, 259, 260 carried out 3x3 windowing 2, respectively. 3x3 windowing circuit 2 241 considers the maximum light color signal 251, 252, 253 as an input, the 3x3 windowing circuit 2242 considers the maximum light color signal 252, 253, 254 as an input, and it is the 3x3 windowing circuit 2. 243 considers the maximum light color signal 213, 214, 215 as an input, and outputs the signal 258, 259, 260 with which the numbers of delay lines differ and which was carried out 3x3 windowing 2, respectively. It is a processing-near point continuing [3x3] circuit, 244 scans the signal 258, 259, 260 with which the numbers of delay lines differ and which was carried out 3x3 windowing 2 in a 3x3-pixel window, and when there is a following-9 pixels [2] or more of 3x3-pixel window pixel, it sets to HI the 1-bit signal 261 by which processing near the point continuing [3x3] was carried out. 245 is an AND gate, calculates the OR of the signal 256 carried out in the 5x5 windowing 2, the signal 261 by which processing near the point continuing [3x3] was carried out, and the achromatic color judging signal 98, and outputs the achromatic-locus detecting signal N.
[0082] 246 is an AND gate, calculates the OR of the signal 256 carried out in the 5x5 windowing 2, and the signal 261 by which processing near the point continuing [3x3] was carried out, and outputs the edge enhancement increase field detecting signal E.
[0083] Drawing 29 is the 5x5 windowing circuit 2 in drawing 28 . It is the block diagram of 240.
[0084] 361 is a 5x5 concentration difference computing element, it considers as an input the maximum light color signals 251 and 252, 253, 254, 255 with which the numbers of delay lines differ, scans said maximum light color signal in a 5x5-pixel window, calculates the difference of the maximum of a pixel, and the minimum value which carried out the mark shown in drawing in the window of 5x5, and outputs the 5x5 maximum light color concentration difference signal 363. An attention pixel is a pixel of the center of the window of 5x5 here. It is a comparator, 362 compares with the maximum light color concentration difference signal 363 of an attention pixel the predetermined threshold 364 which the control section of the copying machine which is not illustrated sets up, and when the monochrome concentration difference signal 363 of an attention pixel is larger than the predetermined value 364, it outputs the signal 256 which is set to HI and which was carried out 5x5 windowing 2.
[0085] Drawing 30 is the block diagram of 3x3 windowing circuit (2) 243 in drawing 28 .
[0086] 378, 379 and 380 are maximum clipping circuits, and consider the maximum light color signal 253, 254, 255 as an input, respectively. Said maximum clipping circuit 378, 379, 380 is clipped at the maximum to which the control section of a copying machine sets an input signal, and outputs the clipped monochrome signal 374, 375, 376, respectively. The maximum clipping circuit 379 outputs the clip detecting signal 377 set to HI, when an attention pixel clips.
[0087] It is a 3x3 window computing element, and 370 considers the clipped maximum light color signal 374, 375, 376 with which the numbers of delay lines differ as an

input, it scans the clipped maximum light color signal in a 3x3-pixel window, and outputs the 3x3 edge component signal 373. Here, the pixel of the center of a 3x3-pixel window is an attention pixel.
[0088] It is a comparator, 371 compares said 3x3 edge component signal 373 with the predetermined threshold 372 which the control section of the copying machine which is not illustrated sets up, and when the 3x3 edge component signal 373 is larger than said predetermined value, it outputs the signal 378 used as HI.
[0089] 381 is an AND gate, calculates the output 378 of a comparator 371, and the OR of the clip detecting signal 377, and outputs the signal 260 carried out 3x3 windowing 2.
[0090] By realizing with a configuration as showed the achromatic-locus detector of drawing 18 , and the edge enhancement increase field detector 92 above, and setting up each threshold the optimal The concentration difference of the maximum light color signal in 5x5-pixel windowing, the edge component of the signal which clipped the maximum in 3x3-pixel windowing near the attention pixel, And since an achromatic-locus field and an edge enhancement increase field are detected from the information on the achromatic color pixel near the attention pixel, the change field from a portion to the light somewhat deep portion of the black alphabetic character circumference is detectable by being able to perform incorrect discernment very few and using the signal clipped by 3x3 windowing.
[0091] The maximum gray concentration field detection, achromatic-locus detection, and edge enhancement increase field detection explain whether a field like an image throat is detected using drawing 31 .
[0092] Drawing 31 is drawing showing a field detection field. The density curve of drawing 31 shows the change to a high concentration field from a low concentration field from the left to the right, and a high concentration field presupposes that it is a black alphabetic character. The field of A is detected with the maximum gray concentration field which should be the maximum gray concentration, and the field of B is an edge enhancement increase field which should make larger than other fields the achromatic locus or edge enhancement which should be colorless. If it judges with a picture signal being colorless, the field of B will be judged to be an achromatic locus. That is, the edge section of a black alphabetic character in case the color is attached to the substrate of a manuscript is detected as an edge enhancement increase field.
[0093] Drawing 32 is the block diagram of the discernment processing circuit 58 in drawing 4 . 400 is a binary-ized circuit, makes binary the monochrome signal Et44 by which edge enhancement was carried out, and outputs the binary-ized monochrome signal 404. A selector 401 chooses the binary-ized monochrome signal 404, when the achromatic-locus detecting signal N is HI, it chooses the monochrome signal 44 by which edge enhancement was carried out when N was LOW, and outputs a signal 405. HI comes, the maximum gray concentration field detecting signal B chooses the maximum concentration data ffH, and when B is LOW, a selector 402 chooses the output 405 of a selector 401, and outputs Signal Etp. 403 is an OR gate, considers the maximum gray concentration field detecting signal B and the achromatic-locus detecting signal N as an input, and outputs a select signal t49. A select signal t49 is a signal which shows the field reproduced only by black color material. A selector 402 may be deleted and the output t of OR gate 403 may be inputted into the selection input SA of a selector 401. The maximum gray concentration field and the detected field are because concentration is large to some extent, so it will become

the signal of the maximum gray concentration if it is made binary in the binary-ized circuit 400.

[0094] Drawing 33 is drawing of the 1st example of the binary-ized circuit 400 in drawing 32 . It is a comparator, 410 compares the monochrome signal 44 by which edge enhancement was carried out with the predetermined threshold 411 which the control section of the copying machine which is not illustrated sets up, and when the monochrome signal 44 by which edge enhancement was carried out is larger than a threshold, it outputs the signal 404 set to HI. A signal 412 is extended to 8 bits and becomes the value of 0 or ffH.

[0095] Drawing 34 is drawing of the 2nd example of the binary-ized circuit 400 in drawing 32 . 420 is memory and the monochrome signal 44 by which edge enhancement was carried out is inputted into the addresses A7-A0 of memory 44. D/D conversion of the monochrome signal 44 by which edge enhancement was carried out is carried out with the look-up table data memorized by memory 420. Memory 420 outputs the signal 404 by which D/D conversion was carried out from the data readout terminals DATA7-DATA0. The look-up table selection signal 421 which the control section of the copying machine which is not illustrated sets up is inputted into the addresses A10-A8 of memory 420, and chooses one of eight look-up table data memorized by memory 420.

[0096] Drawing 35 is drawing showing the example of the data of the look-up table memorized by the memory 420 of drawing 34 .

[0097] Among drawing, if inclination y is made into 90 degrees, it is equivalent to the binary-ized circuit which sets a threshold to x. I hear that making inclination y into 90 degrees or less performs steep contrast conversion, and there is. This contrast conversion is called false binary-ized processing of a threshold x. When inclination y was set as about 90 degrees and expansion processing is carried out by the ZOOM circuit 50 shown in drawing 4, the jaggy to which the edge of a playback image becomes notched occurs. For this reason, according to a dilation ratio, inclination y is made small, and the so-called generating of a jaggy is oppressed. When memory 400 is ROM, memory memorizes two or more look-up tables which changed inclination y and a threshold x, and the optimal look-up table is chosen. When memory 400 is RAM, the optimal look-up table data is downloaded from the exterior. Look-up table data may be not the polygonal line like drawing 35 but a curve.

[0098] Next, the masking circuit 29 in drawing 4 is explained using drawing 36 . Drawing 36 is the block diagram of the masking circuit 29. In drawing 36 , 431 is a matrix operation circuit and outputs picture signal 53Cm by which color correction processing was carried out, 54Mm, and 55Ym by considering the picture signals Ec, Em, and Ey by which edge enhancement was carried out as an input. A matrix arithmetic circuit performs the following operations.

[0099]

amn (m and n are 1-3) is a coefficient for color correction by EyCm=a31, Ec+a32, Em+a33, and Cm=a11, Ec+a12, Em+a13, EyMm=a21, Ec+a22 and Em+a23, and Ey top formula. This masking art is a well-known primary masking method. 432 is a minimum value detector and outputs the smallest value 433 among picture signal 53Cm by which color correction processing was carried out, 54Mm, and 55Ym. 435 is a subtractor and outputs the value 441 which subtracted predetermined value 437Sq from the signal 433 from the minimum value detector 432. Moreover, a subtractor 435 also outputs the code signal 436 which becomes active, when the subtracted value is

negative. 439 is a selector, with the code signal outputted from a subtractor 435, chooses one side among the output of a subtractor 435, and the value 438 of 0, and outputs 56km of black component signals. A selector 439 chooses 438 (a value is 0), when a code signal 436 is negative. Predetermined value 137Sq is called skeleton level, and the black component generation method by this method is the well-known skeleton black method.

[0100]

[Effect of the Invention] As mentioned above, according to the gestalt of this operation, the incorrect discernment identified as a binary image field of fields other than the black alphabetic character section of a manuscript image is reduced, and the black alphabetic character section with few edge components can also be identified.

[0101] Furthermore, as for the digital color copying machine of the gestalt of this operation, when it reappears only by black color material and a black alphabetic character is reproduced to Sharp by sufficient concentration, a location gap is in the color pile of a printer further and coloring of the black alphabetic character edge section does not occur, the black alphabetic character section of a manuscript can reproduce a manuscript image by the high-definition image, and can raise the grace of the playback image of the black alphabetic character section.

[Translation done.]